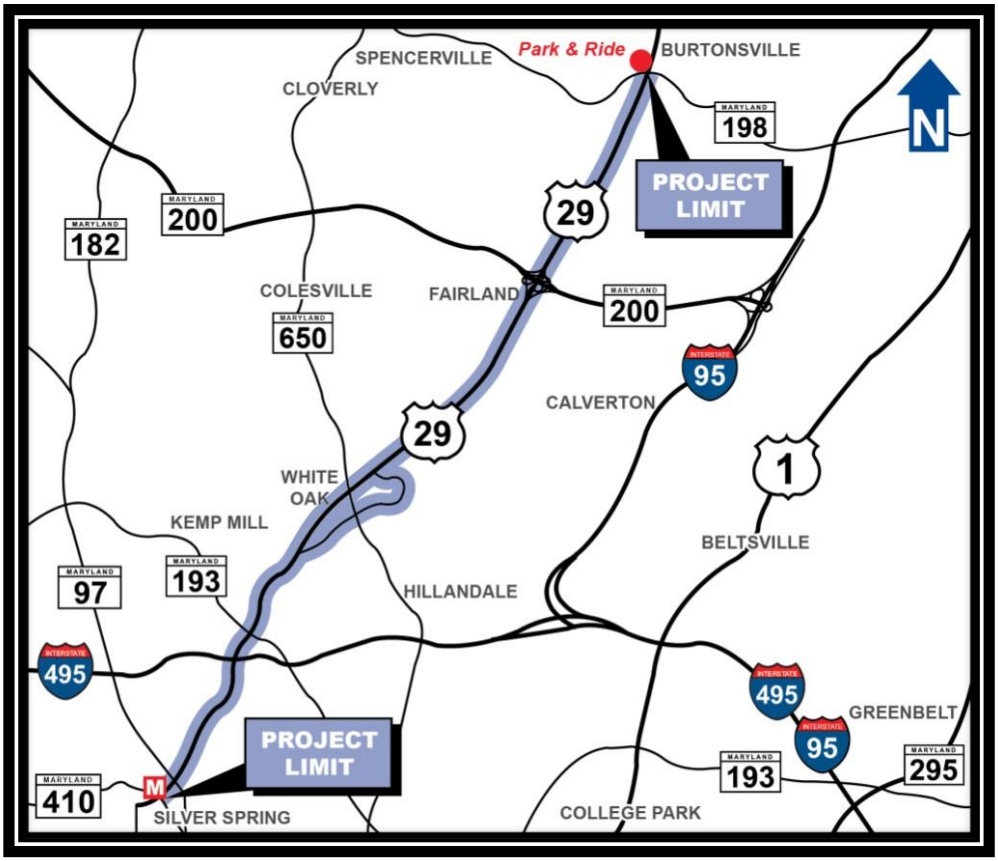
US 29
CORRIDOR PLANNING STUDY

DRAFT CORRIDOR STUDY REPORT

JANUARY 2017



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Executive Summary

This Draft Corridor Study Report (DCSR) documents the evaluation of alternatives to provide new Bus Rapid Transit (BRT) service along US 29 (Colesville Road / Columbia Pike). This study has been completed by the Maryland Department of Transportation's (MDOT) Maryland Transit Administration (MTA), in cooperation with the MDOT State Highway Administration (SHA) and the Montgomery County Department of Transportation (MCDOT).

The US 29 BRT Corridor covers approximately 14 miles of roadway, with mainline US 29 extending from the Silver Spring Transit Center to the Burtonsville Park and Ride in eastern Montgomery County, Maryland (approximately 10 miles) and spurs on Lockwood Drive / Stewart Lane (approximately two miles) and Briggs Chaney Road / Castle Boulevard (approximately two miles). This study includes a review of existing transit and traffic functions and explores possible improvements to transit services and facilities to address current and anticipated future needs in this active and growing part of the County.

BRT, as a form of transit enhancement, is being considered as a possible option for addressing several existing needs: improved transportation options for corridor stakeholders (residents, businesses, commuters, pedestrians, bicyclists, etc.); support for planned land uses and future developments; reduction in single-occupant vehicle dependence; and enhancement to transit reliability for all users. It is anticipated that transit enhancement associated with BRT would also provide opportunities for low-income and minority populations to enhance their quality of life through improved transportation and employment options. Ultimately, BRT improvements have the potential to advance the accessibility, mobility, safety, and sustainability of transportation and related land uses within and surrounding the study area.

In March 2016, the Montgomery County Executive announced a desired plan and budget for BRT on US 29 to be implemented and operational by 2020. To meet this timeline, the project would need to focus on minimizing potentially time-consuming and expensive roadway construction by staying within the existing right-of-way and utilizing existing transportation infrastructure to the extent possible. The County Executive's announcement provided a catalyst for focusing the potential conceptual build alternatives to those discussed later in this DCSR. South of New Hampshire Avenue, lane repurposing options were studied by MTA. To the north existing bus on shoulder operations were investigated for BRT applications.

ES-1 Preliminary Purpose Statement

"The purpose of this project is to improve mobility options by accommodating a high frequency, reliable transit service operating within existing right-of-way to the extent practical between the Silver Spring Transit Center and the Burtonsville Park & Ride with service commencing as quickly as possible."

The preliminary purpose statement translates into the following distinct goals to guide the development of alternatives and as a performance evaluation measures for comparing alternatives:

- Enhance transit connectivity and multi-modal integration along the corridor as part of a coordinated regional transit system;
- Accommodate enhanced, efficient, high frequency, reliable transit service;
- Provide a sustainable and cost effective transit solution;
- Support approved Master Planned residential and commercial growth along the corridor by providing access to transit;
- Address current and future bus ridership demands;
- Attract new riders and provide improved service options for existing riders as an alternative to congested automobile travel through the corridor;
- Improve transit access to major employment and activity centers by connecting more jobs and people within 45 and 60 minutes of the activity centers;
- Utilize existing right-of-way to the extent possible to minimize property and environmental impacts; and
- Commence as quickly as possible.

ES-2 Conceptual Alternatives

Eight preliminary conceptual alternatives were initially developed by the Study Team through incorporating a combination of transit enhancement design elements, including transit service operation updates, station location and platform configurations, and roadway running way options. The preliminary conceptual alternatives were developed from input gathered at workshops between project stakeholders: MTA, SHA, MCDOT, and the US 29 BRT Corridor Advisory Committee (CAC) members.

The Study Team utilized a series of qualitative screening criteria to narrow the preliminary conceptual alternatives down to three retained conceptual build alternatives for further development and more detailed quantitative evaluation and comparison to the no-build

condition. The qualitative screening process evaluated an alternatives general ability to properly meet project purpose and need. The quantitative screening criteria included forecasted 2040 no-build and build transit ridership and bus operations data, forecasted 2040 no-build and build traffic operations, anticipated environmental resource and right-of-way (ROW) impact estimates, and estimated capital and operating costs for proposed roadway and transit improvements.

A conceptual design plan of each of the three retained conceptual build alternatives, including the proposed limits of roadway improvements, station locations, pedestrian and bicyclist facilities, and associated limits of disturbance (LOD), is provided in **Appendix A**.

No-Build Alternative

The No-Build Alternative would not involve improvements to infrastructure or bus service along the US 29 study corridor beyond those improvements already planned and programmed in the regional 2014 Constrained Long-Range Plan (CLRP) for 2040. This plan included more than 300 projects, which will have impacts on the region's roadways and transit networks. Major regional transit projects in the 2014 CLRP include the Silver Line, Corridor Cities Transitway Bus Rapid Transit, and Purple Line. The proposed Purple Line will have a station at the Silver Spring Transit Center, providing intermodal connectivity with Metrorail, Metrobus, Ride On, and the proposed US 29 BRT. **Table ES-1** shows some projects related to the US 29 Study Area.

Table ES-1: Planned/Programmed Projects

Project	From	To	Complete Date
Construct			
Olney Transit Center	Adjacent to or north of MD 108		2015
Purple Line Transitway	Bethesda	New Carrollton	2020
Silver Spring Transit Center	Phase II		2017
US 29 (Columbia Pike)	Interchange at Musgrove/Fairland Rd.		2025
I-95/I-495 (Capital Beltway)	Branch Avenue Metro Access		2020
I-95/I-495 (Capital Beltway)	Full Interchange at Greenbelt Metro		2020
I-95	Contee Road Relocated w/CD Roads		2014
Metrorail Silver Line Phase I	East Falls Church	Reston	2014
Metrorail Silver Line Phase II	Reston	Dulles Airport	2020
Intercounty Connector	I-95	US 1	2014
Takoma Langley Transit Center	Takoma		2016
Study			
Countywide BRT	Various corridors		N/A
US 29, Columbia Pike	north of MD 650	Howard County Line	N/A
White Oak Science Gateway	Various new local roadways, improved existing roadways and transit		N/A

Source: TPB/MWCOG, 2014 CLRP and Fiscal Year (FY) 2015-2020 TIP Air Quality Conformity Inputs. White Oak Science Gateway Master Plan, 2014

The County also anticipates a concentration of development in White Oak as envisioned in the *White Oak Science Gateway Master Plan* (July 2014). Additional development proposed for Fairland and Burtonsville results in growth throughout the US 29 corridor that would benefit from multi-modal transportation networks with high quality transit services. Montgomery County identifies the following planned transportation facilities in the vicinity of the US 29 BRT corridor related to the BRT project:

- Extension of Old Columbia Pike to Lockwood Drive;
- Connector roads between Plum Orchard Court, Whitethorn Court, and Cherry Hill Road;
- Provision of local grid of streets and access roads in Burtonsville; and
- White Oak Science Gateway Master Plan Transportation Improvements (Not currently programmed), which includes:
  - BRT Network
  - Old Columbia Pike Bridge opened to vehicular traffic
  - Planned US 29 grade-separated interchanges at Tech Road/Industrial Road
  - New local roads proposed in the Life Sciences/FDA Village Center
  - Intersection geometric improvements.

For discussion purposes "peak periods" are 6 a.m. to 9 a.m. and 3 p.m. to 7 p.m. while "peak hours" are from 8 a.m. to 9 a.m. and 5 p.m. to 6 p.m.

Alternative A

The main elements of Alternative A would include median shoulder BRT lanes from south of MD 198 to Stewart Lane and intermittent peak period-peak direction curbside business-access-transit lanes (BAT Lanes) with segments of mixed traffic from Stewart Lane to the Silver Spring Transit Center. There would also be segments where buses would run in mixed traffic. The proposed BAT lanes would be created by re-purposing the peak direction curb lane to accommodate BRT buses, local buses, and right turning traffic. See **Figure ES-1** at the end of this Executive Summary for an illustration of the proposed Alternative A improvements.

Alternative B

The main elements of Alternative B would include peak period outside bus-on-outside-shoulder lanes from south of MD 198 to Industrial Parkway and intermittent peak period-peak direction curbside managed lanes (HOV2+ with BAT lanes) with segments of mixed traffic from Oak Leaf Drive/Prelude Drive to the Silver Spring Transit Center. The proposed managed lanes would be created by re-purposing the peak direction curb lane to accommodate vehicles with two or

more passengers, BRT buses, local buses, and right turning traffic. See **Figure ES-2** at the end of this Executive Summary for an illustration of the proposed Alternative B improvements.

Alternative B Modified

The main elements of Alternative B Modified would include median shoulder BRT and Commuter Bus lanes from south of MD 198 to Stewart Lane (similar to Alternative A) and intermittent peak period-peak direction curbside managed lanes (HOV2+ with BAT lanes) with segments of mixed traffic (similar to Alternative B) from Oak Leaf Drive/Prelude Drive to the Silver Spring Transit Center. Again, the proposed managed lanes would be created by re-purposing the peak direction curb lane to accommodate vehicles with two or more passengers, BRT buses, local buses, and right turning traffic. See **Figure ES-3** at the end of this Executive Summary for an illustration of the proposed Alternative B Modified improvements.

Proposed Station Locations

Throughout the study process, the project team has made adjustments to station locations in coordination with Washington Metropolitan Area Transit Authority (WMATA), Maryland-National Capital Park and Planning Commission (M-NCPPC), MCDOT and comments received from US 29 BRT CAC members. The following station locations are proposed for the evaluation of conceptual alternatives (See **Figure ES-4** at the end of this Executive Summary for map of locations):

- Silver Spring Transit Center — Two platforms
- US 29 at Fenton Street/Spring Street — Two platforms
- US 29 at MD 193 (University Boulevard) – Split Ctr Median Station (Alt. A) — One platform
  US 29 at MD 193 (University Boulevard) – Curb Station (Alts. B & B Mod.) — Two platforms
- US 29 at Burnt Mills Shopping Center — Two platforms
- Lockwood Drive at Oak Leaf Drive — Two platforms
- White Oak Transit Center — Two platforms
- Stewart Lane at April Lane — Two platforms
- US 29 at Tech Road Park and Ride - Median Station (Alt. A & B Mod.) — One platform
  US 29 at Tech Road Park and Ride - Curb Station (Alt. B) — Two platforms
- US 29 at Briggs Chaney Road - Median Station (Alt. A) — One platform
  No Station for Alts. B or B Mod.
- Castle Ridge Way at Castle Boulevard — Two platforms
- Castle Terrace at Castle Boulevard — Two platforms
- Briggs Chaney Park and Ride — One platform
- US 29 at MD 198 (Burtonsville Park and Ride) — One platform

Service Operations Plan

A service operations plan that outlines the proposed bus routing, schedules, and vehicle operations costs was developed by MTA for use in the preliminary analysis. Assumptions made for this preliminary analysis are provided below. However, the final service operations plan will likely change and will be appropriately evaluated as the study progresses through later design phases.

Preliminary Service Assumptions

BRT will run on US 29 in both directions. For the purposes of this analysis, BRT service is assumed to operate between 5:00 a.m. and midnight. Service patterns, or the BRT physical routes, will differ during peak and off-peak travel periods. Two service patterns are assumed for the peak period and one service pattern for the off-peak period, and are described in more detail in the section below. Maximum headways, or the time span between consecutive BRT buses (the time between when one bus arrives and when the next bus arrives), are maintained at twelve minutes for peak periods and ten minutes for off-peak periods. Because there are two patterns running during the peak periods, the functional peak headways will be six minutes.

US 29 BRT Pattern One

Peak Period

In the peak period, Pattern One runs between Burtonsville Park and Ride and Silver Spring Transit Center via US 29 with twelve-minute headways. It overlaps Pattern Two in some sections of US 29, reducing the headway to six minutes in those sections. **Figure ES-4** at the end of the Executive Summary provides an overview of the route and stations Pattern One serves during the peak period. Note that the exact location of stations varies for each alternative.

Off-Peak Period

In the off-peak period, Pattern One runs between Burtonsville Park and Ride and Silver Spring Transit Center via Stewart Lane and Lockwood Drive, maintaining ten-minute headways. **Figure ES-4** at the end of this Executive Summary provides an overview of the route and stations Pattern One serves during the off-peak period.

US 29 BRT Pattern Two

In peak periods, Pattern Two runs between Briggs Chaney Park and Ride and Silver Spring Transit Center via Castle Boulevard, US 29, and Stewart Lane/ Lockwood Drive. This pattern maintains twelve-minute headways. In common sections where it overlaps with Pattern One,

the effective headway is six minutes. Pattern Two is assumed to not operate in off-peak hours. See **Figure ES-4** at the end of the Executive Summary for more detail on the route and stations Pattern Two services during the peak period.

ES-3 Alternatives Comparison

As described in detail later in this document, the Study Team took a four-step approach to evaluating the conceptual build alternatives. A summary of the qualitative evaluation results for each of the three conceptual build alternatives, including ridership and traffic operations, as compared with the No-Build condition, is described below and summarized in **Table ES-2**. A summary of anticipated costs, environmental impacts, and property impacts associated with the No-Build and three conceptual build alternatives is also described below and summarized in **Table ES-3**.

- The projected 2040 daily **BRT** boardings for the conceptual build alternatives range from 16,400 to 18,120 passengers. The projected 2040 daily **transit** boardings in the corridor for the conceptual build alternatives range from 33,700 to 34,900 passengers, increasing by 18 to 22 percent over the No-Build conditions.
- Automobile Vehicle Miles Traveled (VMT) is reduced under all three of the conceptual build alternatives as compared to the No-Build.
- Transit Person Miles Traveled (PMT) is increased under all three of the conceptual build alternatives as compared to the No-Build.
- In general, each of the conceptual build alternatives improve person throughput for passengers traveling along US 29, as compared to the No-Build, where person throughput is reduced by 510 to 940 people south of Fenton Street.
- In general, each of the conceptual build alternatives improves transit travel times for passengers traveling along US 29, as compared to the No-Build, with BRT passengers saving as much as 20.5 minutes compared to the No-Build local buses.
- The number of accessible jobs forecasted to be within 45 minutes of the corridor, via transit, increases between 1.9 percent and 2.3 percent under the three conceptual build alternatives as compared to the No-Build.
- The number of activity centers forecasted to be within 45 minutes of the corridor, via transit, increases between 3.9 percent and 4.7 percent under the three conceptual build alternatives as compared to the No-Build.

- The forecasted 2040 number of miles of roadway operating at level of service (LOS) E or F along the corridor in the PM peak hour shows a decrease from 5.4 miles in the No-Build to 2.1 to 3.7 miles under the conceptual build alternatives. The AM peak hour shows an increase from 7.3 miles under No-Build to up to 8.9 miles under the conceptual build alternatives.

- Alternative A would have one additional intersection operating at LOS E or F, a total of 25, as compared to No-Build (24 total). Alternatives B and B Modified match the No-Build at 24 intersections operating at LOS E or F in both the AM and PM peak hours.

- The estimated cost to purchase the required ROW for the conceptual build alternatives ranges from $1.5 million to $4.5 million (in 2016 dollars), and the amount of ROW required for the conceptual build alternatives ranges from 2.0 acre to 6.0 acres.

- The estimated cost of construction for the conceptual build alternatives ranges from $60 million to $112.4 million and the total capital cost, including ROW and vehicles, ranges from $79 million to $136.4 million in 2016 dollars.

- The estimated annual operating costs of the conceptual build alternatives range from $7.6 million to $9.8 million in 2016 dollars.

- The estimated number of properties impacted by the conceptual build alternatives ranges from five to 30. There are no property displacements or relocations anticipated at this time. The number of impacted properties is presented as a range. The actual effects would be determined by the final locations and size of BRT stations and roadway improvements based on further development of the conceptual build alternatives.

- The number of public parks impacted by the conceptual build alternatives ranges from zero to two and the estimated acreage impacted would range from zero acres to 0.2 acres.

- The estimated number of public facilities impacted by the conceptual build alternatives ranges from zero to three.

- The estimated number of historic structures impacted by the conceptual build alternatives ranges from zero to one. No archaeological sites are anticipated to be impacted; however, additional studies would be required to as the conceptual alternatives are further developed.

- The estimated linear feet of streams impacted by the conceptual build alternatives range from zero to 125. The 100-year floodplain impacts range from zero to 1.0 acre. The estimated wetland impacts range from zero to less than 0.2 acre. The estimated forest impacts range from 1.0 acre to 5.0 acres.

- None of the conceptual build alternatives are estimated to have disproportionately high adverse impact on minority or low-income populations. It is estimated that the conceptual build alternatives may impact between 0.2 acre and 1.0 acre of potential Environmental Justice communities, primarily for the construction of BRT stations. However, this impact may be further refined as the conceptual build alternatives are further developed, and it is anticipated that these communities will benefit directly from the new transit service provided.

Table ES-2: Alternatives Comparison Matrix – 2040 Ridership and Traffic

Evaluation Criteria		No-Build Alternative		Alternative A[1]		Alternative B[2]		Alternative B Modified[3]	
		AM	PM	AM	PM	AM	PM	AM	PM
Ridership[4]									
Total Daily Transit Boardings		28,500		34,900		33,700		34,400	
Total Daily BRT		N/A		18,100		16,400		17,300	
Peak Period (6 am – 9 am and 3 pm – 7 pm) Person Throughput[5]									
NB	South of Fenton Street	1,390	3,260	1,560	2,320	1,580	2,490	1,590	2,750
	North of Franklin Avenue	2,090	4,770	2,450	4,470	2,370	4,670	2,390	4,700
	South of Burnt Mills Shopping Center	3,140	5,300	3,450	5,100	3,430	5,540	3,440	5,590
	On Lockwood Drive	500	940	640	1,290	630	1,250	630	1,250
	North of Stewart Lane	3,080	4,000	3,290	4,490	3,310	4,460	3,310	4,590
	North of Greencastle Road	3,060	3,940	3,070	4,200	3,070	4,170	3,090	4,230
SB	North of Greencastle Road	4,410	3,410	4,720	3,420	4,660	3,420	4,740	3,430
	North of Stewart Lane	3,270	3,260	3,310	3,550	3,590	3,510	3,610	3,560
	On Lockwood Drive	340	500	790	650	780	640	790	540
	South of Burnt Mills Shopping Center	4,450	3,390	4,480	3,670	4,950	3,630	4,950	3,610
	North of Franklin Avenue	4,480	2,580	4,410	2,720	4,980	2,670	5,010	2,690
	South of Fenton Street	3,730	1,790	3,990	1,950	4,150	2,010	4,230	1,990
Peak Hour Travel Times in Minutes: End-to-End (Silver Spring Transit Center to Burtonsville Park and Ride)									
NB	Cars and Trucks	18.6	35.3	18.4	43.2	19.5	32.1	18.6	32.4
	Local Buses	27.5	44.5	26.7	38.5	27.4	37.2	27.0	31.8
	BRT	N/A	N/A	22.8	36.5	23.1	34.3	23.6	26.9
SB	Cars and Trucks	44.0	24.3	58.7	21.5	48.3	24.3	51.1	24.1
	Local Buses	49.4	27.3	60.2	28.3	33.0	28.9	29.0	27.3
	BRT	N/A	N/A	34.8	25.5	33.3	27.8	28.9	26.4
Vehicle Miles Traveled (VMT) and Transit Person Miles Traveled (PMT) in Study Corridor									
Reduction in Daily Automobile VMT, as compared to the No-Build		N/A		3,220		10,110		9,680	
Increase in Daily Transit PMT, as compared to the No-Build		N/A		34,800		26,300		19,170	

Table ES-2: Alternatives Comparison Matrix – 2040 Ridership and Traffic, Continued

Evaluation Criteria	No-Build Alternative		Alternative A		Alternative B		Alternative B Modified	
	AM	PM	AM	PM	AM	PM	AM	PM
Accessibility								
Change in Number of Jobs within 45 Minutes of the Corridor, via Transit, as compared to the No-Build	N/A		2.2%		1.9%		2.3%	
Change in Number of Jobs within 60 Minutes of the Corridor, via Transit, as compared to the No-Build	N/A		<1%		<1%		0%	
Change in Number of People within 45 Minutes of the Corridor Activity Centers, via Transit, as compared to the No-Build	N/A		4.7%		4.1%		3.9%	
Change in Number of People within 60 Minutes of the Corridor Activity Centers, via Transit, as compared to the No-Build	N/A		<1%		<1%		0%	
Traffic Operations								
Miles of LOS E or F Operations Along the Corridor	7.3	5.4	8.3	2.1	8.1	3.7	8.9	2.6
Intersections Operating at LOS E or F	7	17	9	18	8	16	9	15

1. Alternative A – BAT Lanes in south, Median Shoulder BRT Lanes in north (BRT buses only)
2. Alternative B – Managed Lanes (BAT/HOV2+) in south, Bus-On-Outside-Shoulder in north
3. Alternative B Modified – Managed Lanes (BAT/HOV2+) in south, Median Shoulder BRT Lanes in north (BRT and Commuter buses only)
4. Values are rounded to the nearest 100.
5. Values are rounded to the nearest 10.

Table ES-3: Alternatives Comparison Matrix – Costs and Environmental Impacts

	Evaluation Criteria	No-Build Alternative	Alternative A	Alternative B	Alternative B Modified
COSTS[1]	Right-of-way (ROW)	$0	$1.5M-$3M	$2M-$4.5M	$1.5M-$3M
	Construction	$0	$80M - $112.4M	$60M-$107.9M	$77M-$105.6M
	Vehicles	$0	$21M	$17M	$19M
	Total Capital Cost	$0	$102.5M-$136.4M	$79M-$129.4M	$97.5M-$127.6M
	Annual Operating Cost	$0	$8.8M-$9.8M	$7.6M-$8.6M	$8.5M-$9.5M
ENVIRONMENTAL IMPACTS	***Socioeconomic***				
	Total ROW Required (acres)	0	2-4	3-6	2-4
	Properties Impacted (number)	0	5-20	20-30	5-20
	Residential Relocations (number)	0	0	0	0
	Business Displacements (number)	0	0	0	0
	Public Parks Affected (number)	0	1	1	1
	Public Park Property Required (acres)	0	0-0.2	0-0.2	0-0.2
	Total Number of Public/Community Facilities Permanently Impacted	0	1	2	2
	Cultural Resources				
	Historic Properties (acre)	0	0-0.1	0-0.1	0-0.1
	Natural Resources				
	Stream Impact (linear feet)	0	0-20	0-125	0-20
	100-Year Floodplain (acres)	0	0-0.5	0-1	0-0.5
	Wetlands (acres)	0	0-0.2	0-0.2	0-0.2
	Forests (acres)	0	1-3	2-5	1-3
	Federally or State Listed RTE Species (number)	0	0	0	0

1. Costs presented in 2016 dollars and as ranges developed using SHA estimating guidelines to account for currently unknown design and construction needs.

ES-4 Public Involvement

MCDOT maintains and regularly updates the county Bus Rapid Transit Project website to provide the public with information about the US 29 BRT Corridor Study: https://www.montgomerycountymd.gov/brt/

As part of approving the Montgomery County Planning Board's *Countywide Transit Corridors Functional Master Plan* (2013), the Montgomery County Council called for the formation of two CAC for the US 29 Corridor. One CAC group represents the southern portion of the study corridor, the other group represents the north. The CACs give community residents and

business owners/operators the opportunity to provide comments and make recommendations to the Study Team throughout the planning process.

To date, eight CAC meetings have been held:

US 29 South CAC

- Meeting #1 – February 28, 2015
- Meeting #2 – March 31, 2015
- Meeting #3 – June 2, 2015
- Meeting #4 – September 10, 2015
- Meeting #5 – December 2, 2015
- Meeting #6 – May 24, 2016
- Meeting #7 – July 14, 2016
- Meeting #8 – September 26, 2016
- Meeting #9 – January 31, 2017

US 29 North CAC

- Meeting #1 – February 28, 2015
- Meeting #2 – March 26, 2015
- Meeting #3 – May 28, 2015
- Meeting #4 – September 8, 2015
- Meeting #5 – December 1, 2015
- Meeting #6 – May 18, 2016
- Meeting #7 – July 20, 2016
- Meeting #8 – September 22, 2016
- Meeting #9 – February 2, 2017

Combined CAC Open House

In addition to the above referenced CAC meetings, there was a combined South and North US 29 CAC Open House on February 1, 2016.

Through the course of the CAC process, CAC members have participated in discussions on many topics relevant to the BRT Corridor Planning Process. Among the topics covered during the process were:

- The Project Development Process
- US 29 Existing Conditions
- Existing and Forecasted Transit Ridership
- Existing and Forecasted Traffic Operations
- Draft Preliminary Purpose and Need
- Alternatives Selection Analysis Goals and Objectives
- Conceptual Alternatives Development
    - Running way Options
    - Preliminary Service Plan
    - Preliminary Station Locations

CAC meetings have included exercises and open discussions to spur questions and comments that contribute to project planning and the community's understanding of the project.

Information regarding past and planned CAC meetings is maintained on MCDOT's BRT website at: http://www.montgomerycountymd.gov/BRT/cac.html.

Additional public involvement and engagement with the CAC, associated with the public review of the DCSR, are detailed as part of the Next Steps.

ES-5 Next Steps

This DCSR will be made available for comment from January 19 through February 20, 2017. The DCSR and appendices, will be made available, by link, on the project website: https://mta.maryland.gov/us29brt

Written comments may be submitted during the public review period by email to US29BRT@mta.maryland.gov or mail to:

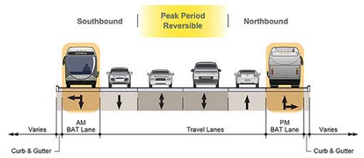
Tamika Gauvin, Consultant Project Manager
Maryland Transit Administration
Office of Planning and Programming
Suite 902, 6 Saint Paul Street, Baltimore, MD 21202

Following the comment period, it is anticipated that the project team, will develop a Final CSR that will address the comments received to the extent possible. The Final CSR will be made available on the project website, provided above.

Alternative A
Reversible Peak Direction Curbside BAT* Lanes
From Georgia Avenue to Sligo Creek Parkway
(Looking North)

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 35

Segment Length: 0.9 Miles

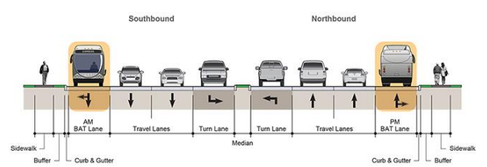


* Business Access Transit (BAT) Lanes (BRT/Local Bus/Right Turns)

Alternative A
Peak Direction Curbside BAT Lanes
From Sligo Creek Parkway to Oak Leaf Drive
(Looking North)

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 45

Segment Length: 2.1 Miles



Alternative A
Mixed Traffic

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 45

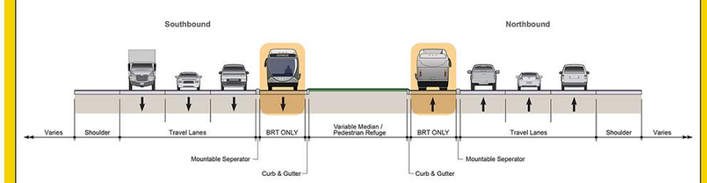
Segment Length: Varies

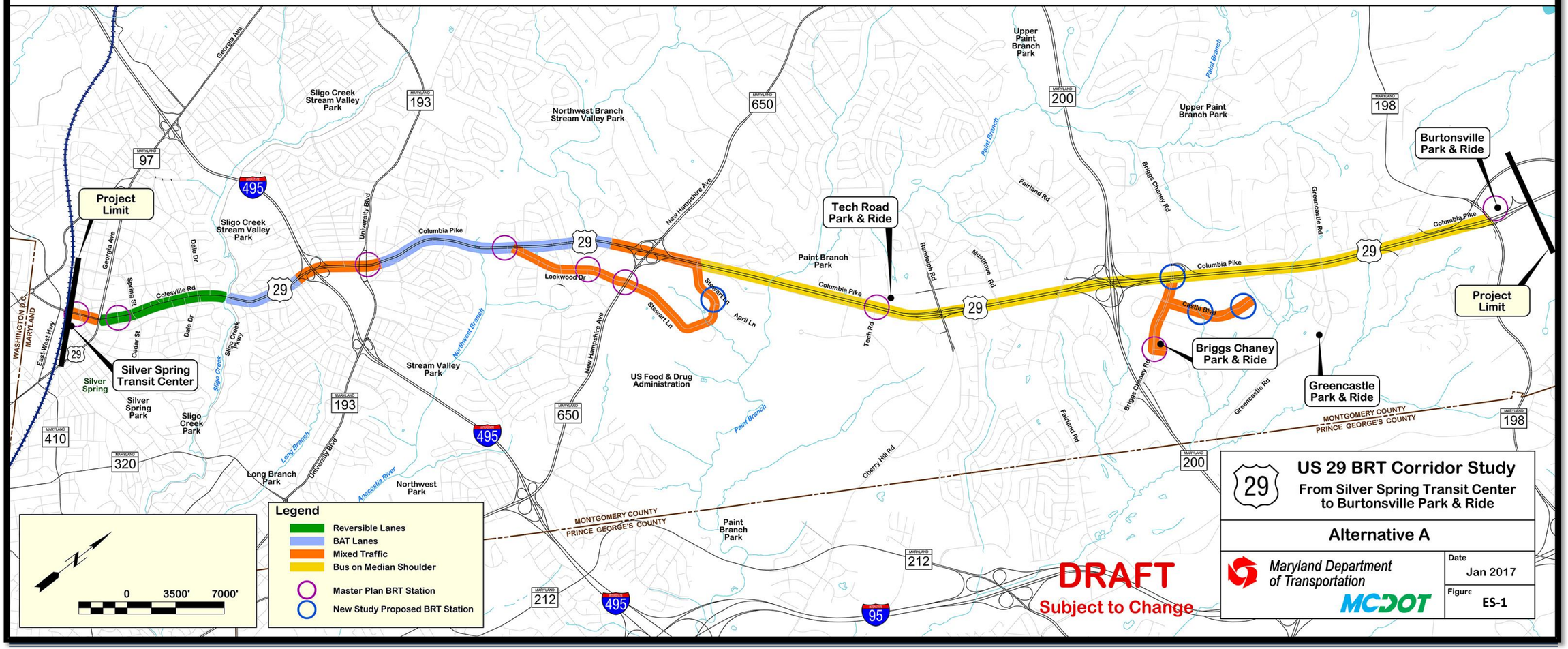
BRT IN MIXED TRAFFIC.
TYPICAL SECTIONS MATCH EXISTING CONDITIONS.

Alternative A
Median Shoulder BRT Lanes
From Stewart Lane to MD 198
(Looking North)

Posted Speed Limit: SPEED LIMIT 50 / SPEED LIMIT 55

Segment Length: 5.6 Miles





DRAFT
Subject to Change

US 29 BRT Corridor Study
From Silver Spring Transit Center to Burtonsville Park & Ride

Alternative A

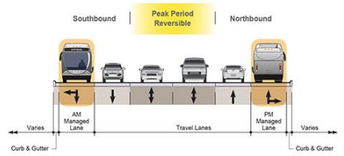
Maryland Department of Transportation
MCDOT

Date: Jan 2017
Figure: ES-1

Alternative B
Reversible Peak Direction Curbside Managed* Lanes
(BRT/HOV2+/Local Bus/Right Turns)
From Georgia Avenue to Sligo Creek Parkway
(Looking North)

Posted Speed Limit: 30 / 35

Segment Length: 0.9 Miles

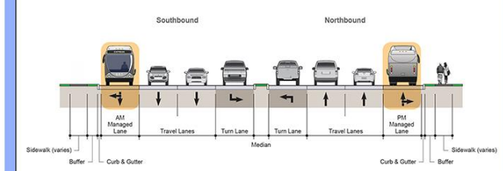


* Managed Lanes
(BRT/HOV2+/Local Bus/Right Turns)

Alternative B
Peak Direction Curbside Managed Lanes
(BRT/HOV2+/Local Bus/Right Turns)
From Timberwood Avenue to Oak Leaf Drive
(Looking North)

Posted Speed Limit: 30 / 45

Segment Length: 1.7 Miles



Alternative B
Mixed Traffic

Posted Speed Limit: 30 / 50

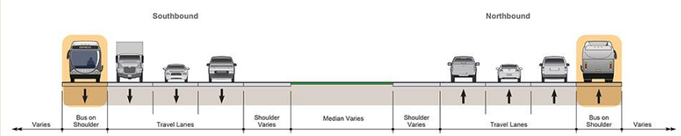
Segment Length: Varies

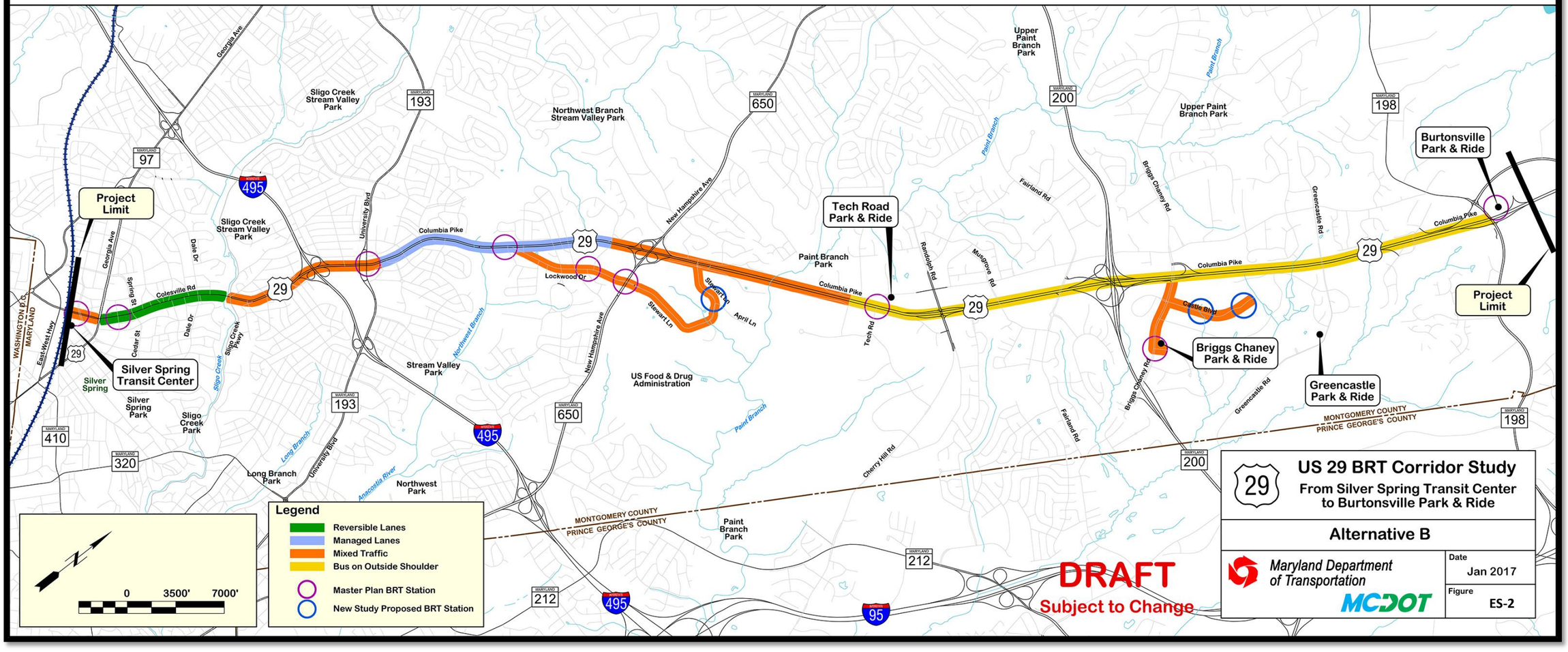
BRT IN MIXED TRAFFIC.
TYPICAL SECTIONS MATCH EXISTING CONDITIONS.

Alternative B
Bus On Outside Shoulder
From Industrial Parkway to MD 198
(Looking North)

Posted Speed Limit: 50 / 55

Segment Length: 4.8 Miles

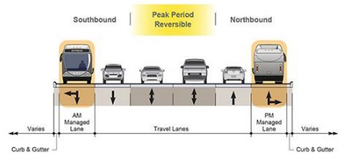




Alternative B Modified
Reversible Peak Direction Curbside Managed* Lanes
(BRT/HOV2+/Local Bus/Right Turns)
From Georgia Avenue to Sligo Creek Parkway
(Looking North)

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 35

Segment Length: 0.9 Miles

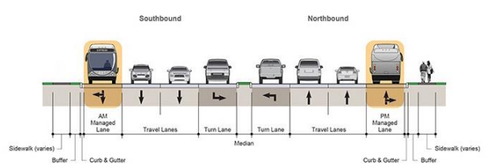


* Managed Lanes
(BRT/HOV2+/Local Bus/Right Turns)

Alternative B Modified
Peak Direction Curbside Managed Lanes
(BRT/HOV2+/Local Bus/Right Turns)
From Sligo Creek Parkway to Oak Leaf Drive
(Looking North)

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 45

Segment Length: 2.1 Miles



Alternative B Modified
Mixed Traffic

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 45

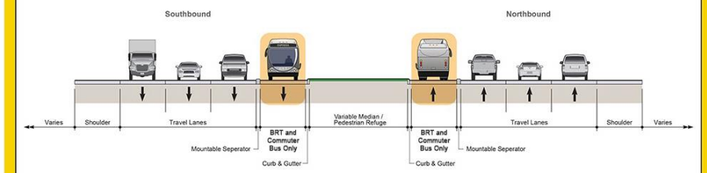
Segment Length: Varies

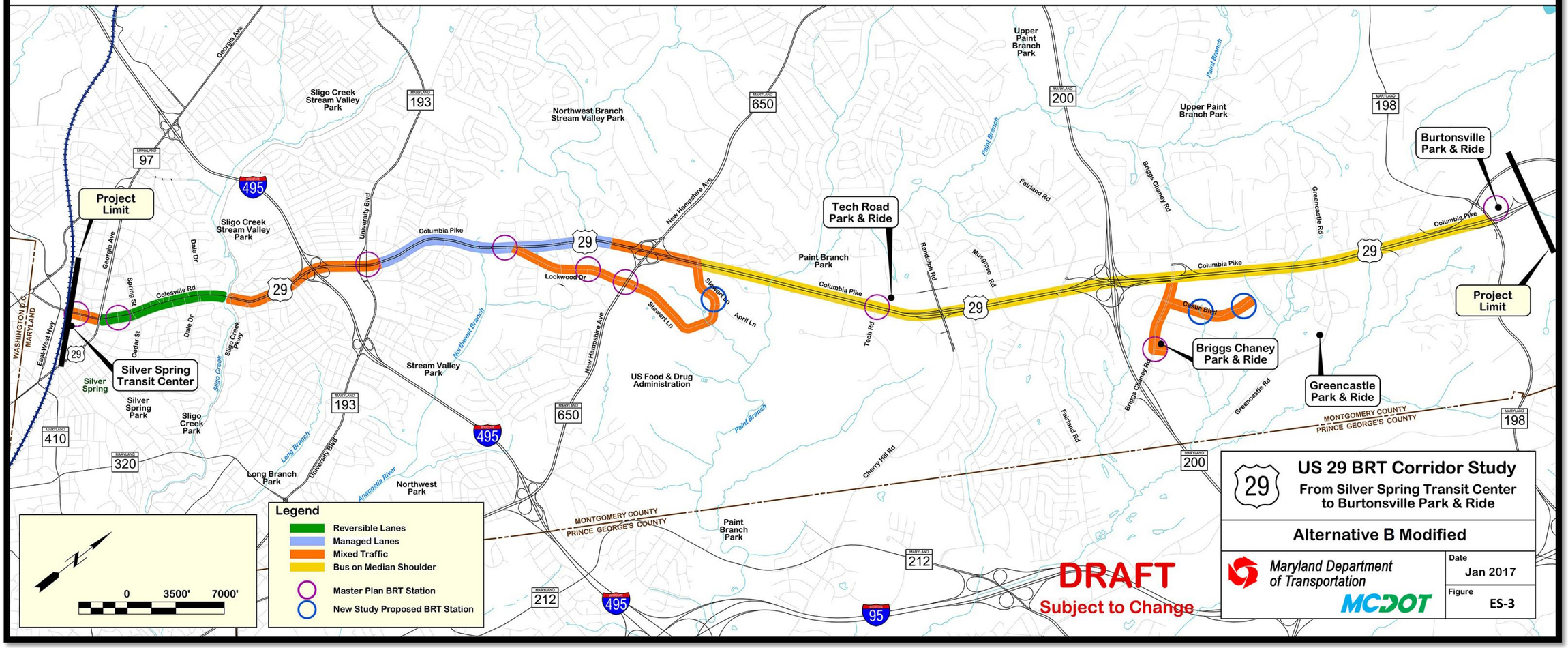
BRT IN MIXED TRAFFIC.
TYPICAL SECTIONS MATCH EXISTING CONDITIONS.

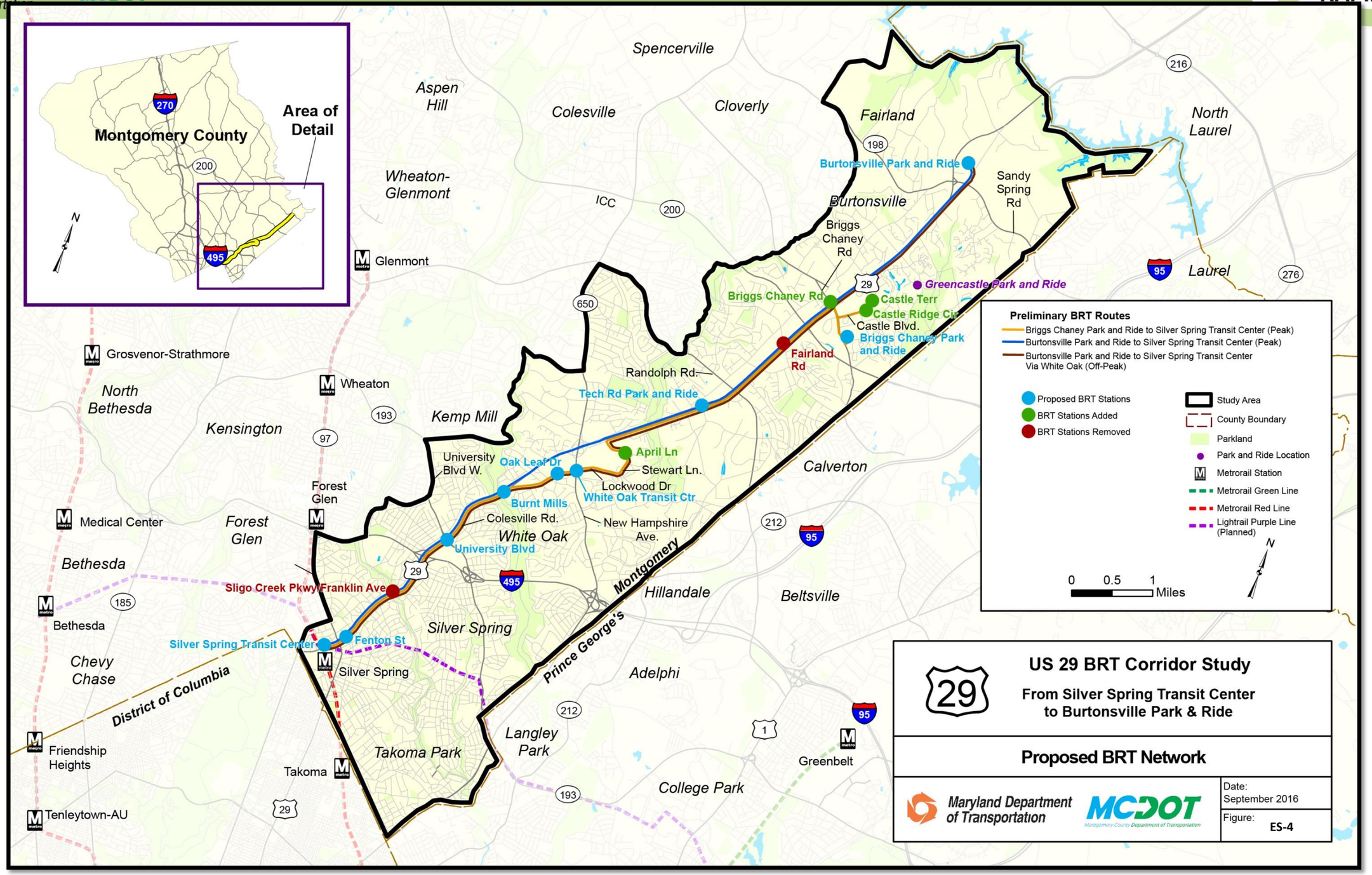
Alternative B Modified
Median Shoulder BRT Lanes
From Stewart Lane to MD 198
(Looking North)

Posted Speed Limit: SPEED LIMIT 50 / SPEED LIMIT 55

Segment Length: 5.6 Miles






Area of Detail
Montgomery County
270
495
200
N
Spencerville
Aspen Hill
Colesville
Cloverly
Fairland
North Laurel
216
198
Burtonsville Park and Ride
Sandy Spring Rd
Wheaton-Glenmont
ICC
200
Burtonsville
Briggs Chaney Rd
Glenmont
650
29
Greencastle Park and Ride
Briggs Chaney Rd
Castle Terr
Castle Ridge Cir
Castle Blvd.
Briggs Chaney Park and Ride
95
Laurel
276
Fairland Rd
Grosvenor-Strathmore
Randolph Rd.
Wheaton
North Bethesda
Tech Rd Park and Ride
193
Kemp Mill
Kensington
97
April Ln
University Blvd W.
Oak Leaf Dr
Stewart Ln.
Lockwood Dr
White Oak Transit Ctr
Calverton
Forest Glen
Burnt Mills
Colesville Rd.
New Hampshire Ave.
Medical Center
Forest Glen
White Oak
University Blvd
212
95
Bethesda
29
495
Sligo Creek Pkwy/Franklin Ave
Montgomery
Hillandale
Beltsville
185
Bethesda
Silver Spring Transit Center
Fenton St
Silver Spring
Prince George's
Chevy Chase
District of Columbia
Adelphi
212
95
1
Langley Park
Takoma Park
Takoma
Friendship Heights
Greenbelt
193
College Park
29
Tenleytown-AU
Preliminary BRT Routes
Briggs Chaney Park and Ride to Silver Spring Transit Center (Peak)
Burtonsville Park and Ride to Silver Spring Transit Center (Peak)
Burtonsville Park and Ride to Silver Spring Transit Center Via White Oak (Off-Peak)
Proposed BRT Stations
BRT Stations Added
BRT Stations Removed
Study Area
County Boundary
Parkland
Park and Ride Location
Metrorail Station
Metrorail Green Line
Metrorail Red Line
Lightrail Purple Line (Planned)
N
0 0.5 1 Miles
US 29 BRT Corridor Study
From Silver Spring Transit Center to Burtonsville Park & Ride
Proposed BRT Network
Maryland Department of Transportation
MCDOT
Date: September 2016
Figure: ES-4

1 Introduction

The Maryland Department of Transportation (MDOT), through two of its business units, the Maryland Transit Administration (MTA) and the State Highway Administration (SHA), has partnered with the Montgomery County Department of Transportation (MCDOT) to evaluate a proposed Bus Rapid Transit (BRT) line along US 29 (Colesville Road/Columbia Pike) between the Silver Spring Transit Center and the Burtonsville Park and Ride in Montgomery County, Maryland. The intent of this Corridor Planning Study is to identify transportation needs and evaluate potential alternatives for accommodating enhanced transit service via BRT. These BRT alternatives are to be implemented within the existing curbs and right-of-way as much as possible.

1.1 What is Bus Rapid Transit (BRT)?

BRT is an innovative, high-capacity, and cost effective public transit solution that has been shown to significantly improve urban mobility in cities across the U.S. This integrated system uses specialized buses on roadways or dedicated lanes to quickly and efficiently transport passengers to their destinations, while offering the flexibility to meet transit demand (e.g. higher frequencies, all-day service, etc.). BRT systems can easily be customized to community needs and incorporate state-of-the-art technology that attracts more passengers and improves transit reliability. BRT stations typically include passenger shelters and loading platforms, level bus boarding, real-time bus arrival information, automated off-board fare collection, and site treatments such as pedestrian improvements, bike accommodations, landscaping and lighting enhancements. BRT vehicles are typically specialized buses with low floors that have multiple doors on both sides of the vehicle, increased passenger circulation and bicycle provisions, higher capacity through use of articulated buses, enhanced passenger amenities, and a unique brand identity. See **Figures 1-1, 1-2, 1-3, and 1-4** throughout this section as examples of BRT in other cities.

Figure 1-1: Emerald Express, Eugene, OR

BRT service features stations that are spaced farther apart than local bus stops. Buses may operate in dedicated lanes reserved exclusively for BRT, or in shared travel lanes used by BRT

buses and other traffic. Infrastructure improvements like traffic signal priority (TSP) and special bus bypass lanes or "queue jumps" can provide buses travel enhancement options at intersections aimed at providing superior travel experience with potentially fewer congestion-related delays. In cities where BRT has been implemented, it has been described as a bus that offers the convenience of rail transit with lower capital cost.

1.2 Bus Rapid Transit Planning in Montgomery County

Montgomery County first proposed BRT as the most appropriate mode for improving transit in the corridor in the 1993 Strategic Transit Plan. Improvements to county transit systems have been proposed, discussed, and evaluated in several other county planning documents since then.

Figure 1-2: Select Bus Service, New York, NY

In 2011, MCDOT completed a Countywide Bus Rapid Transit Study, which provided an initial look at the possibility of BRT along several main county transportation routes, including US 29. The study was a proactive effort to explore transit improvements that could address the existing travel demand and the anticipated growth in overall (vehicle and transit) trips in Montgomery County. The study provided an overview of multiple study corridors with associated existing and future transit demand and recommended potential improvements for each.

Acting upon the findings from the 2011 document and the recommendations for enhanced transit included in several other local area and sector plans, the Maryland-National Capital Park and Planning Commission (M-NCPPC) developed a Countywide Transit Corridors Functional Master Plan (CTCFMP). This plan was approved and adopted by the Montgomery County Council in December 2013.

The CTCFMP proposes the development of a BRT network throughout the County to support the County's mobility, land use, and economic development goals. To ensure network integrity and achieve the County's vision, the document outlines recommendations and provides the basis for the rights-of-way reservations required to accommodate enhanced transit improvements (i.e., bus lanes, stations, roadway widening, etc.) in individual transit corridors. The CTCFMP also makes recommendations on the allocation of space for transportation system facilities related to motor vehicle traffic, transit, pedestrians, and bicycles. One of several

corridors included in the CTCFMP is US 29 from the Silver Spring Transit Center to the Burtonsville Park and Ride.

Figure 1-3: RTC, Las Vegas, NV

Specific to US 29, the CTCFMP proposes the following recommendations, from north to south:

- Along US 29 from MD 198 to Stewart Lane, up to two additional dedicated lanes;
- Along Stewart Lane and Lockwood Drive, a mixed traffic operation;
- Along US 29 from Stewart Lane to Sligo Creek Parkway, dedicated lanes;
- Along US 29 from Sligo Creek Parkway to Georgia Avenue, a dedicated lane in the peak-hour peak direction; and
- Along US 29 from Georgia Avenue to Sixteenth Street, dedicated lanes.

CTCFMP Proposed Station Locations:

- Burtonsville park and ride
- Briggs Chaney park and ride
- US 29 and Fairland Road
- US 29 and Tech Road
- White Oak Transit Center
- Lockwood Drive and Oak Leaf Drive
- US 29 and Hillwood Drive
- US 29 and MD 193
- US 29 and Franklin Avenue
- US 29 and Fenton Street Silver Spring Transit Center

Table 1-1 summarizes the CTCFMP Proposed Dedicated Lanes, ROW, and Maximum Additional Transit Lanes:

Table 1-1: CTCFMP Proposed Dedicated Lanes, ROW, and Maximum Additional Transit Lanes

Road	From	To	Dedicated Lane(s)?	R.O.W.**	Maximum Additional Transit Lanes
US 29	MD 198	Stewart Ln	Yes	200	2
Stewart Lane	US 29	Lockwood Drive	No	80	0
Lockwood Drive	Stewart Ln	New Hampshire Ave	No	80	0
Lockwood Drive	New Hampshire Ave	US 29	No	80	0
US 29	Stewart Lane	Lockwood Drive	Yes	122	0
US 29	Lockwood Dr	Southwood Ave	Yes	122	0
US 29	Southwood Ave	Sligo Creek Pkwy	Yes	120	0
US 29	Sligo Creek Pkwy	Fenton St	Yes*	120	0
US 29	Fenton St	Georgia Ave	Yes*	100	0
Colesville Road	Georgia Ave	East West Hwy	Yes	125	0
Colesville Road	East West Hwy	16th St	Yes	125	0

*The six existing general purpose lanes in these segments currently operate during peak hours as four in the peak direction and two in the off-peak direction; in off-peak hours, they operate as three lanes in each direction. This Plan recommends that the operation in peak hours there be a dedicated lane in the peak direction.

**Reflects the minimum right-of-way, and may not include land needed for spot improvements such as turn lanes and stations.

The US 29 corridor has been specifically identified as the implementation priority within the CTCFMP's proposed BRT network for the following reasons:

1. BRT will support fast –paced growth in the county. With a current population of more than one million people, Montgomery County has the largest-growing population of any county in Maryland. Per US Census (2010), the County added more than 166,000 people between 2000 and 2015. The County is projected to add another 162,000 people between 2015 and 2040 according to the Metropolitan Washington Council of Governments (MWCOG), Household, Population and Employment Projection, Round 8.3.

2. Planned White Oak development in the corridor will create additional vehicle trips that will increase congestion and could be addressed with high quality transit options.
3. Existing traffic challenges could be addressed with BRT by providing additional transportation options.
4. Silver Spring Transit Center provides a multi-modal hub link to get to downtown Washington, D.C. (DC) via Metrorail and other bus routes.
5. The corridor has an existing strong transit market with robust bus ridership. BRT transit services could enhance the quality of life for over 146,000 people who live within the US 29 Study Area.

Figure 1-4: Metro Liner, Los Angeles, CA

Corridor Snapshot

- Two regional activity centers, Silver Spring and White Oak, serve as an engine for activities and travel in the Study Area

- Strong employment growth in these two regional activity centers is forecasted for 2040, with a growth of almost 80 percent over current levels

- Trips traveling through the study area (i.e., not originating from the study area) represent a significant share of travel market for the Study Area, with approximately 40 percent of total trips expected in 2040

- DC is a major destination of commuter trips from the Study Area, with approximately 22,000 trips commuting from US 29 to DC

- Another major DC-bound commuting flow of approximately 10,000 trips originates from Howard County

- Severe congestion exists at several locations along the US 29 corridor and is forecasted to exacerbate in the future 2040 condition

- The Study Area has a strong transit market, including an average weekday daily Metrorail boardings of approximately 13,000 for Silver Spring Station and more than 15,000 boardings for the Metrobus Z line buses, Ride On buses, and MTA commuter buses

- Provides convenient and reliable connections to other transit systems, including local Ride On and Metrobus service, Metrorail Red Line, and the future Purple Line light rail

2 Existing and Forecasted 2040 Conditions

This section compiles and summarizes information collected to reflect existing and forecasted future transportation infrastructure, socio-economic conditions, and land uses.

2.1 Study Area and Study Corridor

This study focuses on US 29 in eastern Montgomery County, MD and the surrounding communities, employment areas, activity centers, and infrastructure facilities it serves. On a larger scale, Montgomery County is part of the DC metropolitan area, and US 29 is a major north-south highway within the National Highway System. As part of the National Highway System, US 29 is a vital transportation corridor that begins in Howard County, MD near Ellicott City and ends in Pensacola, FL. Within Maryland, US 29 is a multi-lane partially access controlled highway, where traffic flows are frequently separated by interchanges and dividing medians. US 29 is the westernmost north-south route between DC and the Baltimore area and provides a crucial link for the movement of people and freight.

In order to provide an assessment of the existing features and needs of the transportation and community facilities in the area, the Study Team has identified two areas of focus that surround the segment of US 29 under investigation: the Study Area and the Study Corridor. The Study Area surrounds the Study Corridor and is defined for the purposes of evaluating travel demand, traffic patterns, community features, and socio-economic characteristics. The narrower Study Corridor is contained within the Study Area and is defined for the purposes of evaluating potential impacts to adjacent land uses, natural and cultural resources, existing infrastructure elements, and transportation operations and safety.

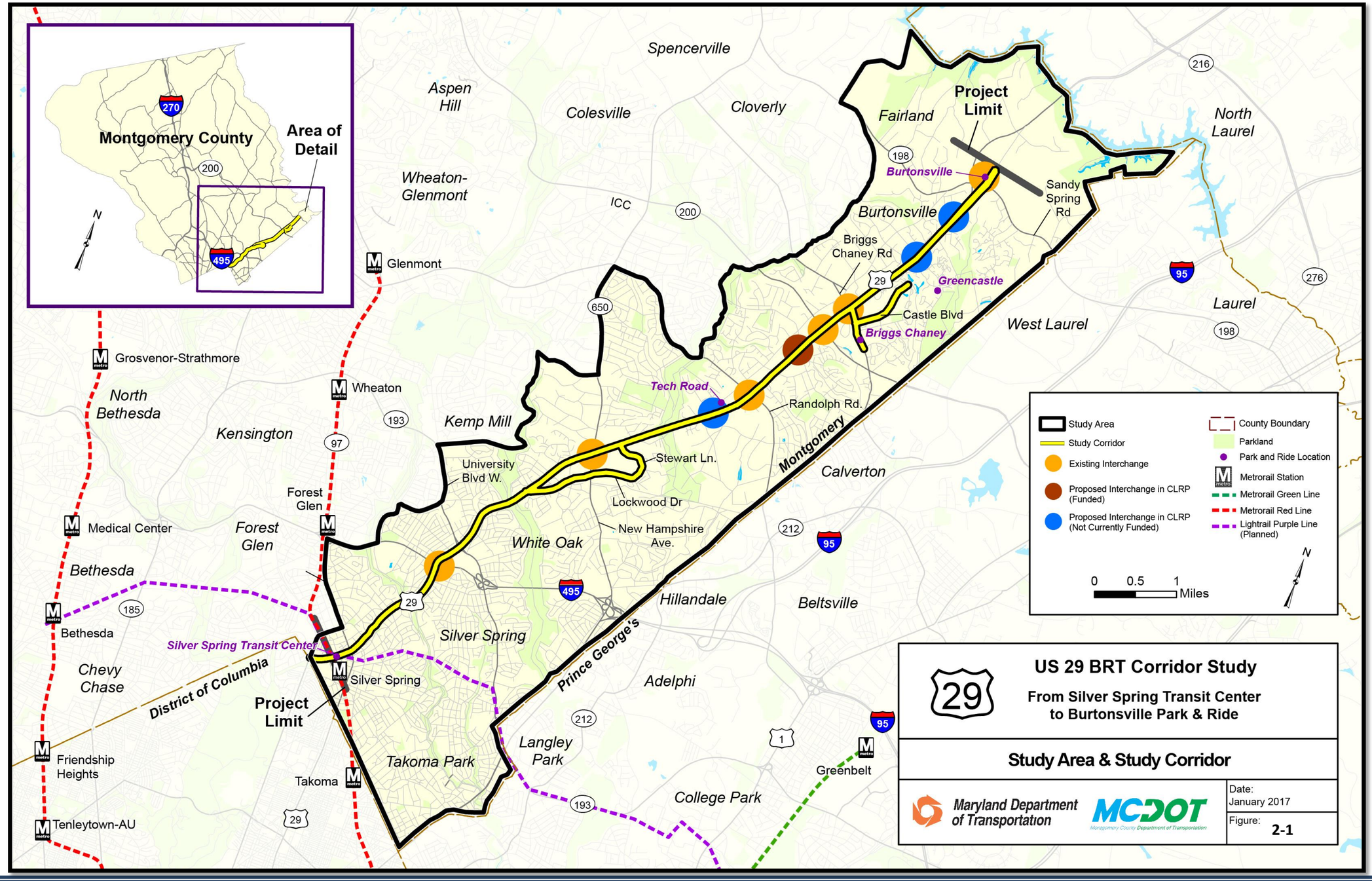
The Study Area (see **Figure 2-1**) is an aggregate of Transportation Analysis Zones (TAZs) from the Metropolitan Washington Council of Governments / Transportation Planning Board (MWCOG/TPB) Regional Travel Demand Model and bounded by:

- The border of Montgomery County with Prince George's County on the east;
- The border of Montgomery County with Howard County on the north;
- The border of Montgomery County with District of Columbia on the south; and
- A study team generated border approximately one mile west of US 29, based on TAZs.

TAZs are geographic areas commonly used in conventional transportation planning models. The size of each zone may vary, depending on the policies and procedures of the metropolitan planning organization, but are typically generated to define an area occupied by approximately 3,000 people. These TAZs often include US Census based data on socio-economic

characteristics, employment, number of households and household income, and number of vehicles to compute existing and forecasted trips.

The 14-mile Study Corridor, including mainline US 29 from the Silver Spring Transit Center to the Burtonsville Park and Ride (approximately 10 miles) and the spurs on Lockwood Drive/Stewart Lane (approximately two miles) and Briggs Chaney Road/Castle Boulevard (two miles) (see **Figure 2-1**) is comprised of the existing community and infrastructure features and facilities located within or adjacent-to the existing US 29 right-of-way for up to 200-feet on either side of the existing edge of pavement. The Study Corridor has a south terminus at the Silver Spring Transit Center and a north terminus at the Burtonsville Park and Ride, and includes spurs on Lockwood Drive and Stewart Lane and Briggs Chaney Road and Castle Boulevard. The Study Corridor intersects with arterial roadways such as University Boulevard (MD 193), New Hampshire Avenue (MD 650), East Randolph Road/Cherry Hill Road, Fairland Road, Spencerville Road/Sandy Spring Road (MD 198), and freeways such as I-495 and MD 200. A new interchange is proposed at Fairland Road/Musgrove Road and is funded for advancement in the 2014 CLRP;. However it is currently on hold. There are several other potential interchanges proposed within the Study Corridor. However they are not included for funding in the CLRP at this time (See **Figure 2-1**).


Montgomery County
Area of Detail
N
270
200
495
Spencerville
Aspen Hill
Colesville
Cloverly
Fairland
Project Limit
216
North Laurel
198
Burtonsville
Sandy Spring Rd
Wheaton-Glenmont
ICC
200
Burtonsville
Briggs Chaney Rd
Glenmont
29
Greencastle
95
276
650
Castle Blvd
Briggs Chaney
West Laurel
Laurel
198
Grosvenor-Strathmore
Tech Road
Randolph Rd.
Wheaton
193
Kemp Mill
North Bethesda
Kensington
97
Stewart Ln.
University Blvd W.
Montgomery
Calverton
Forest Glen
Lockwood Dr
New Hampshire Ave.
212
Medical Center
Forest Glen
White Oak
95
Bethesda
495
Hillandale
Beltsville
185
29
Bethesda
Silver Spring Transit Center
Silver Spring
Prince George's
Chevy Chase
District of Columbia
Project Limit
Adelphi
212
95
Langley Park
1
Friendship Heights
Takoma Park
Takoma
Greenbelt
193
College Park
29
Tenleytown-AU
Study Area
Study Corridor
Existing Interchange
Proposed Interchange in CLRP (Funded)
Proposed Interchange in CLRP (Not Currently Funded)
County Boundary
Parkland
Park and Ride Location
Metrorail Station
Metrorail Green Line
Metrorail Red Line
Lightrail Purple Line (Planned)
0 0.5 1 Miles
N
US 29 BRT Corridor Study
From Silver Spring Transit Center to Burtonsville Park & Ride
Study Area & Study Corridor
Maryland Department of Transportation
MCDOT
Montgomery County Department of Transportation
Date: January 2017
Figure: 2-1

2.1.1 Land Use

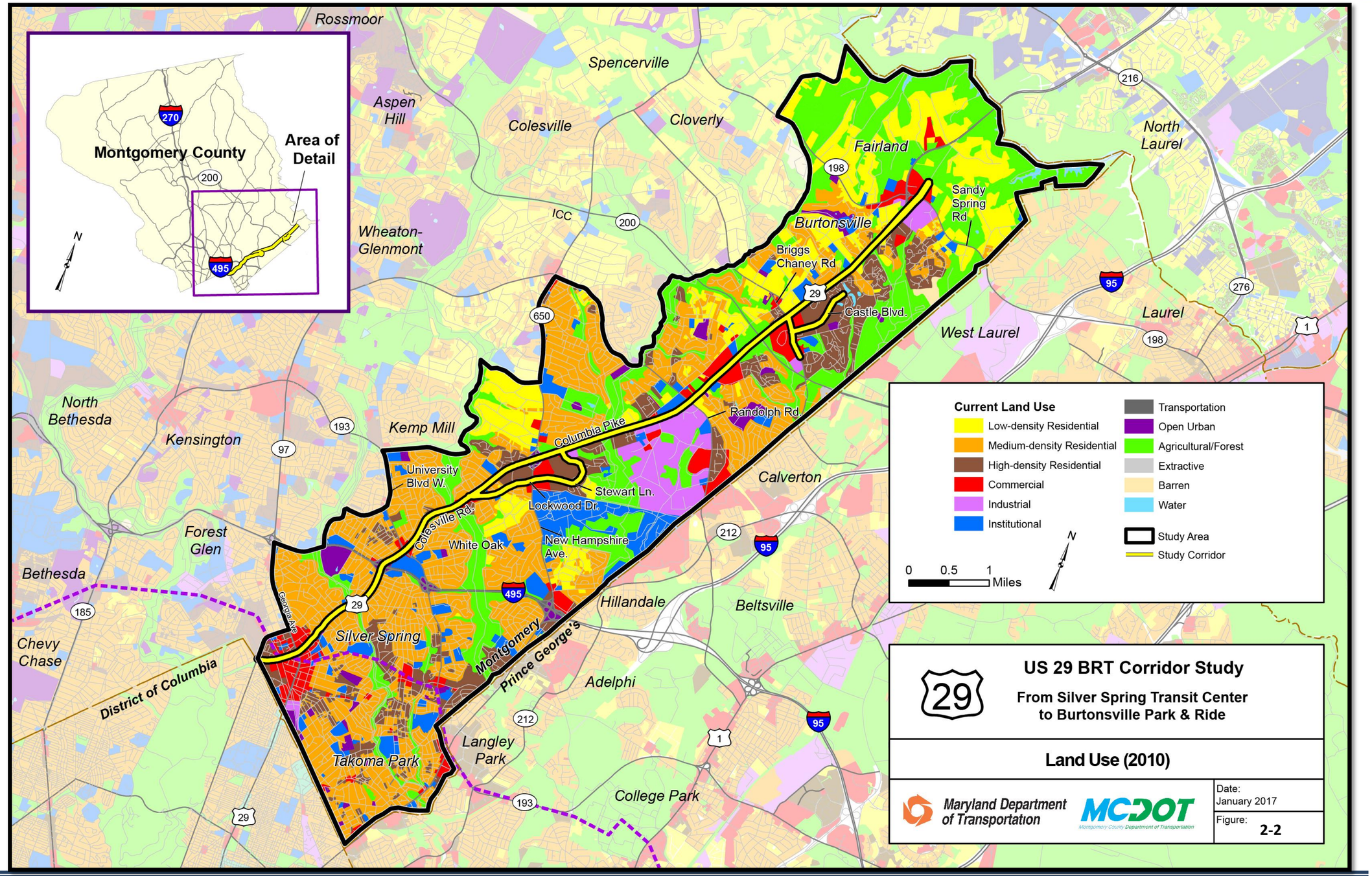
US 29 within the Study Area serves as the spine that links the residential communities from Silver Spring to Burtonsville, with the regional activity and growth generators at Silver Spring and White Oak. Additional significant activity centers that are a short distance away include DC, and Howard County. US 29 and the existing transit services in the Study Corridor offer quality service to their users. There are local bus services that serve shorter-distance trips with frequent stops, and there are commuter transit services providing mostly for peak hour commuting patterns with fewer stops. There is growing concern that these existing services may not meet needs of the riders travelling within and through the Study Corridor as the area continues to change and grow.

Residential communities are located throughout the Study Area (see **Figure 2-2**). There is a mixture of low, medium, and high density residential areas, with concentrations of high density residential development near MD 650 and in downtown Silver Spring. Four Corners, Fairland, Burtonsville, and White Oak are just a few of the 14 well established residential communities in the Study Corridor. Commercial and institutional land uses are also dispersed throughout the corridor. Some industrial uses are located in the northern half of the Study Corridor near Industrial Parkway and Tech Road. A summary of land use types and corresponding acreages within the Study Corridor and Study Area are provided in **Table 2-1**.

Table 2-1: Land Uses and Acreage within Study Corridor and Study Area

Land Use Type	Area (Acreage) within Study Corridor	Area (Acreage) within Study Area
Low Density Residential	23	2,530
Medium Density Residential	132	6,581
High Density Residential	106	2,016
Commercial	136	979
Industrial	27	675
Institutional	33	1,339
Transportation	132	295
Open Urban Land	14	365
Agriculture/Forest	63	4,446
Water/Wetlands	4	76

Source: Maryland Department of Planning and SHA



US 29 BRT Corridor Study

From Silver Spring Transit Center to Burtonsville Park & Ride

Land Use (2010)

Maryland Department of Transportation MCDOT Montgomery County Department of Transportation

Date: January 2017

Figure: **2-2**

The commercial/retail uses are concentrated near the Silver Spring Transit Center, White Oak, and Burtonsville. White Oak and Silver Spring are regional activity centers expected to drive growth in the area, as envisioned by the White Oak Science Gateway Master Plan and the Silver Spring Central Business District (CBD) Sector Plan approved and adopted by the M-NCPPC.

The White Oak Science Gateway Master Plan covers nearly 3,000 acres and envisions development that includes the existing U.S. Food and Drug Administration (FDA) Headquarters and Research Center, a Life Sciences/FDA Village, and the Hillandale Community.

The Silver Spring CBD Sector Plan envisioned and laid the foundation for much of the development that has happened in the CBD. Downtown Silver Spring is home to Discovery Communications, the National Oceanic and Atmospheric Administration, and numerous retail, civic and entertainment venues that were envisioned for its revitalization and new development. The Sector Plan also drives the vision for future development.

2.1.2 Population, Jobs, and Income

In 2014, population in the Study Area was estimated at 119,500 according to the MWCOG/TPB. Of those living in the corridor, the nearly 62 percent are minorities and five percent of the households in the Study Area are considered low-income and living below the poverty line according to 2010 decennial US Census Data.

The MWCOG/TPB estimates the 2014 number of households at 52,100 and employment at 67,400 jobs in the Study Area. The activity centers at White Oak and Silver Spring are expected to drive future growth in the Study Area.

Based on the 2010 US Census, as well as more recent 2015 American Community Surveys, Maryland has the highest median household income in the country. The most recent 5-yr estimate is $72,483. Montgomery County is the second wealthiest county within the state, with a median household income of $98,326. The percentage of the population living below poverty for the state and the county are ten percent and seven percent respectively.

The average median household income in the Study Area is $95,292, which is about three percent lower than the County's median income. The percentage of the population living below poverty in the Study Area is five percent, which is two percent less than the County's overall population living below poverty. There are concentrations of the population with the highest median household incomes in the northwest portion of the Study Area and northern Silver Spring in the vicinity of US 29 and University Boulevard (MD 193). The areas with the lowest median household incomes are located in the northeast section of the Study Area, as well as the southern portion of the Study Area near downtown Silver Spring.

2.1.3 Corridor Travel Patterns - Study Area Daily Trip Patterns

Potential travel markets for the proposed US 29 BRT depend on major travel patterns related to the US 29 BRT Study Area[1]. To facilitate discussion of travel patterns, regional districts were defined for areas of the TPB model region (see **Figure 2-3**), with a detailed focus on Montgomery County, including the five Montgomery districts (I-270 West, I-270 East, MD 97, US 29, Inside Beltway), the District of Columbia, Columbia/Ellicott City, Rest of Maryland, and Virginia.

Figure 2-4 highlights the major worker flows which are a significant segment of the potential markets for the US 29 BRT, based on the 2006-2010 Census Transportation Planning Products (CTPP) compiled by Federal Highway Administration (FHWA). Similarly, **Figure 2-5** displays the major flow patterns of outbound person trips from a home or non-home location, based on the 2014 TPB/MWCOG model results, while **Figure 2-6** shows the forecasted 2040 flow patterns.

Major travel patterns shown in the following tables and figures can be summarized in terms of potential markets for the proposed US 29 BRT as follows:

- Internal trips within the US 29 Study Area represent a significant share of travel market for the study area, with 37 percent of total trips of the study area in 2014;
- Internal trips are expected to increase by 29 percent in between 2014 and 2040;
- DC-bound commuting trips were a major out-flow of trips from the study area, with 19,500 residents in the study area commuting to DC for work, based on the 2006-2010 CTPP;
- Another major DC-bound commuting flow of approximately 10,000 trips were from Columbia and Ellicott City areas north of the US 29 BRT Corridor, which can use US 29 as a commuting route to DC;
- A smaller number of workers also commuted to work in the study area from Columbia and Ellicott City areas (3,400) and DC (4,000); and
- Major trip flows from the model results for 2014 and 2040 show patterns similar to the commuting flows described above.

Trips to the study area were forecasted to increase significantly because of strong employment growth, for example, by 29 percent from Columbia and Ellicott City areas and DC.

[1] The ***US 29 BRT Draft Preliminary Purpose and Need***, (December 2015) includes additional information on travel patterns in the Study Area. Tables 2.4 and 2.5 show the district-level flows of daily person trips for 2014 and 2040, respectively, based on the MWCOG/TPB Version 2.3.57 model results.

Figure 2-3: Regional District Definition

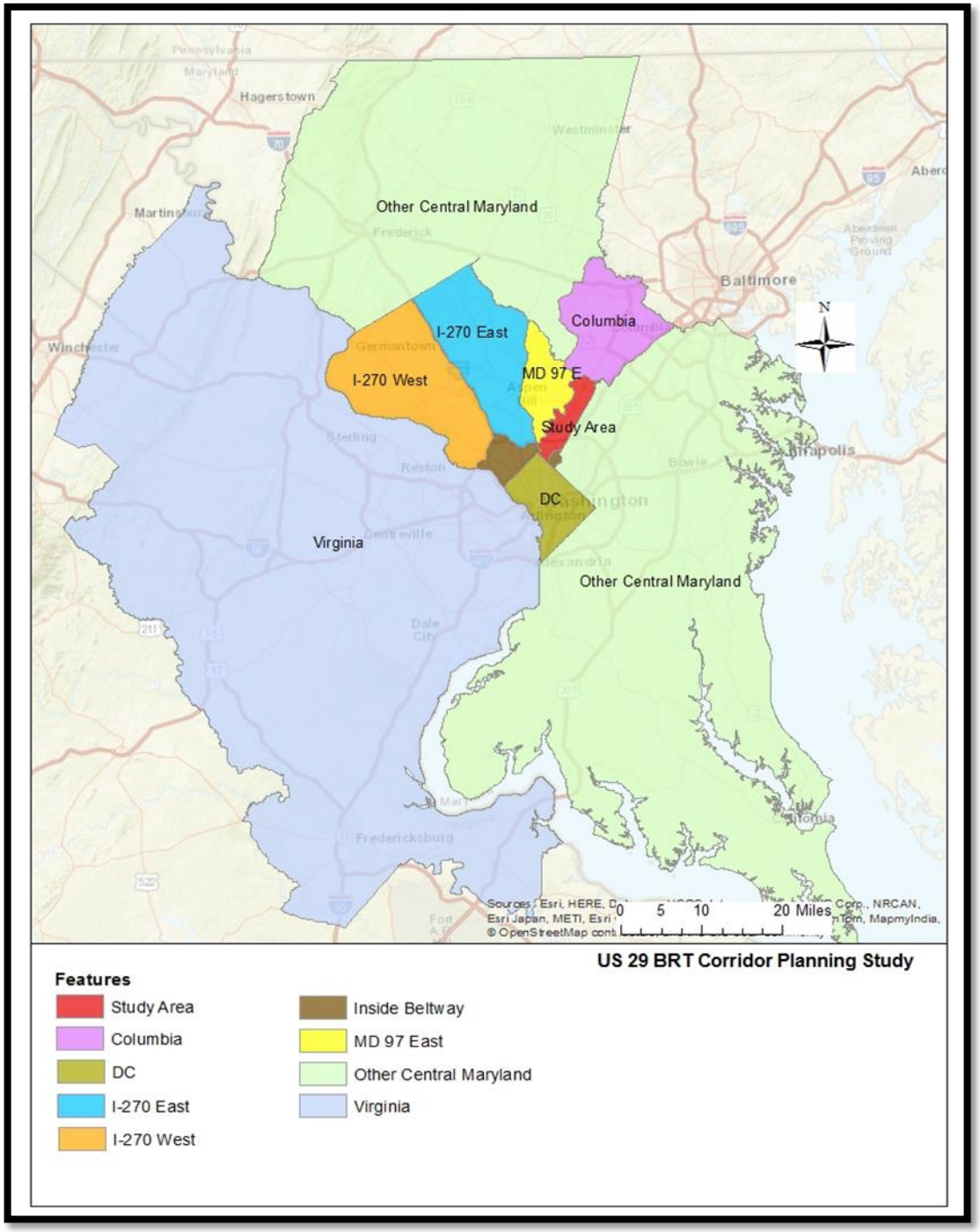
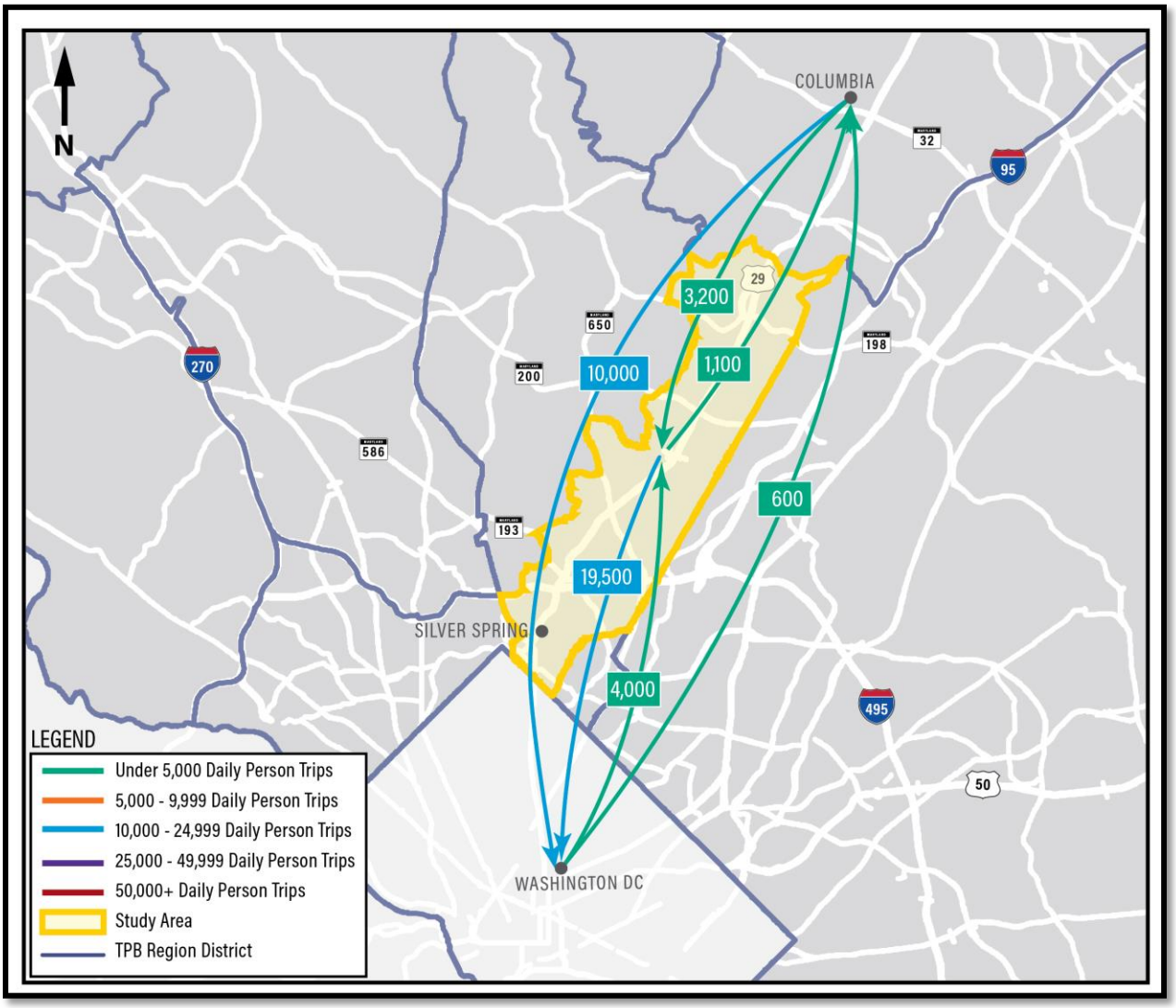
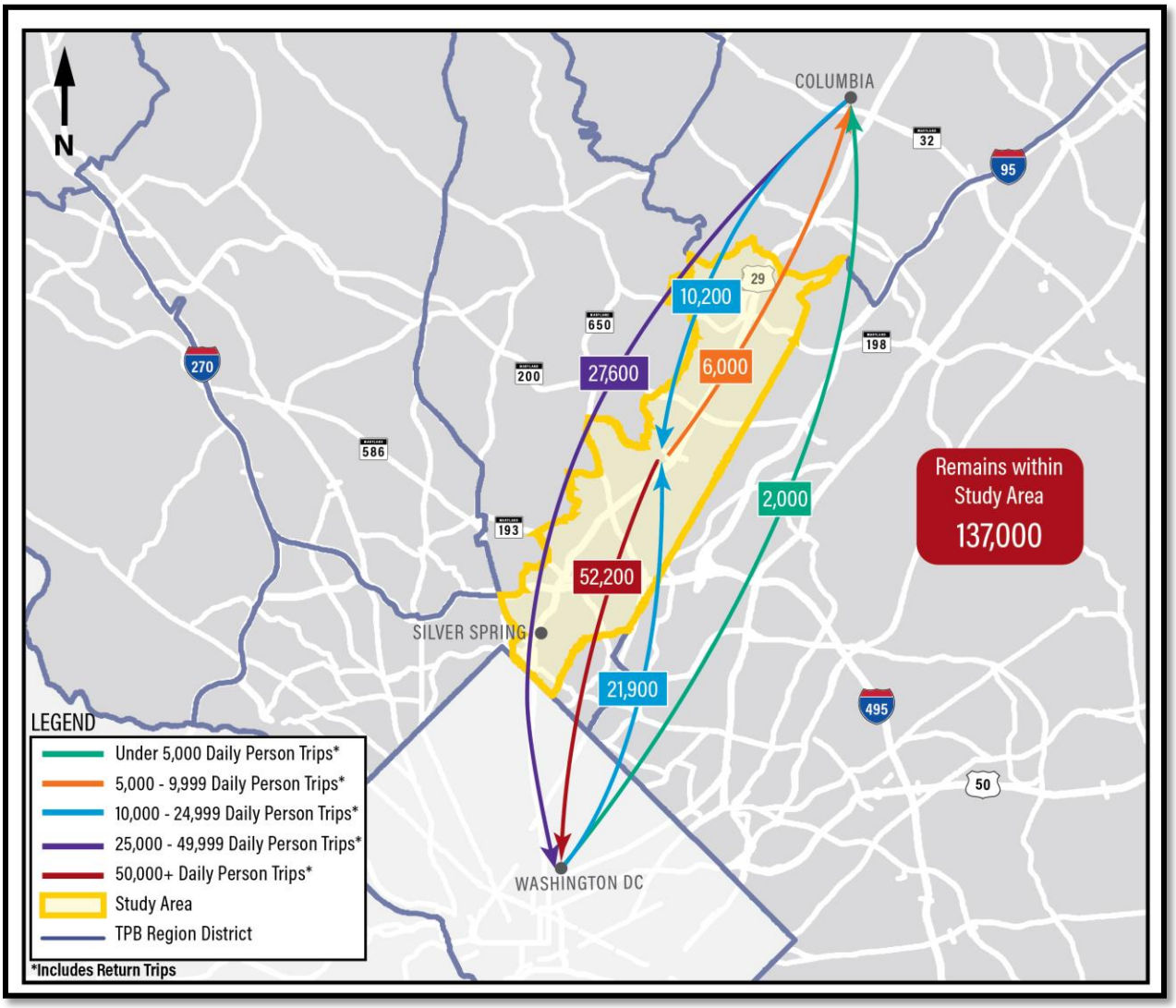


Figure 2-4: Worker Commuting Flows (2006-2010)



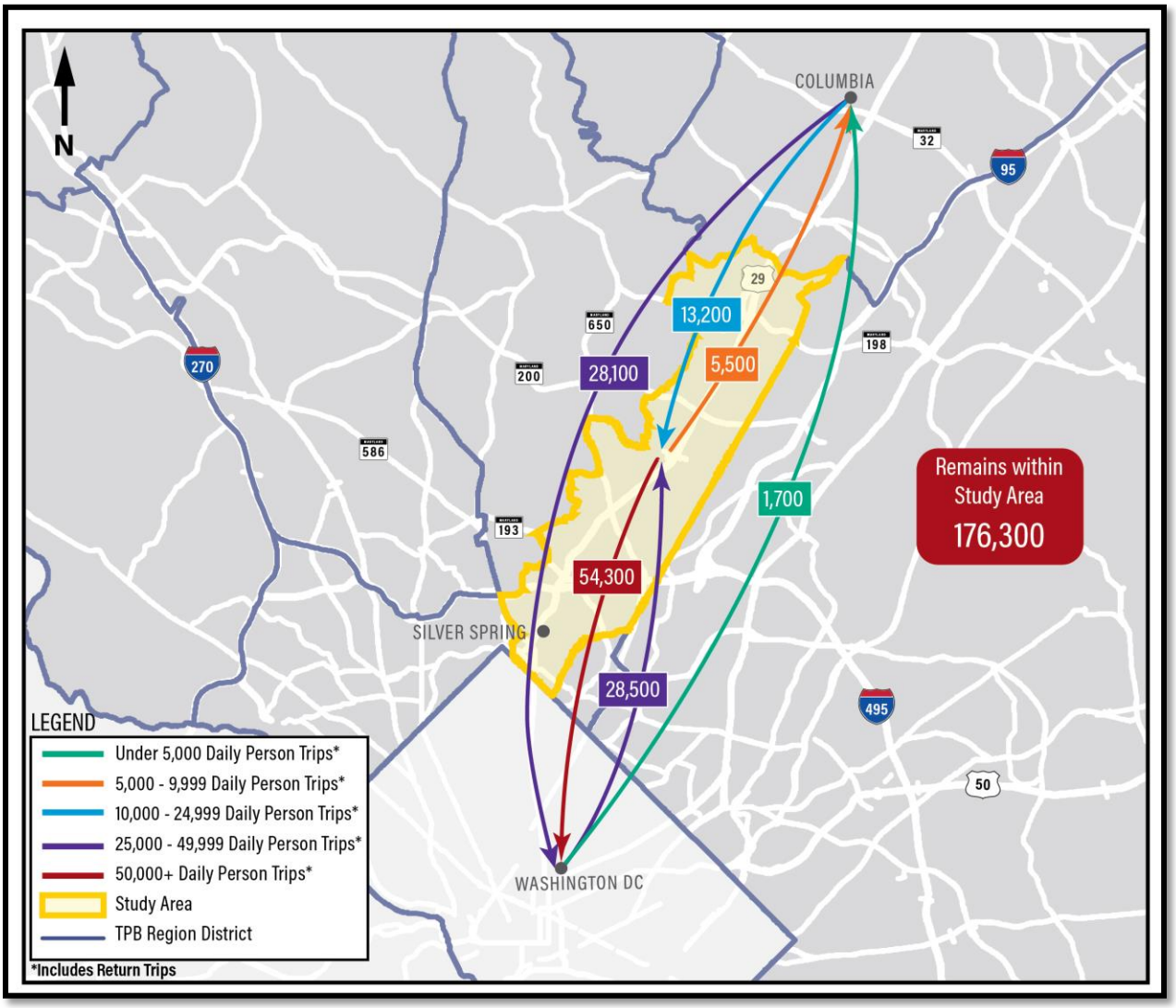
Data Source: 2006-2010 CTPP. Note that internal flows are not included.

Figure 2-5: Travel Patterns – Person Trips (2014)



Data Source: TPB/MWCOG Model for 2014. These trips are outbound trips from a home or a non-home location and include return trips.

Figure 2-6: Travel Patterns – Person Trips (2040)



Data Source: TPB/MWCOG Model for 2040. These trips are outbound trips from a home or a non-home location and include return trips.

2.2 Transit Conditions

2.2.1 Existing Transit Services

One of the key assets of the US 29 Corridor Study Area is its existing transit services. Montgomery County Ride On, Washington Metropolitan Area Transit Authority (WMATA) Metrobus Z-line bus, and the MTA Commuter Bus operate in the corridor. WMATA provides Metrorail Red Line service at the Silver Spring Station, which is near the recently completed Silver Spring Transit Center.

The Transit Center serves as a hub for the Metrorail, MARC, Ride On, Metrobus, and local shuttle services. It is also a future stop for the planned Purple Line Light Rail, scheduled to be completed in 2021. The MTA MARC Brunswick Commuter Rail Line stops in Silver Spring are less than a block away from the Metrorail station. Understanding the transit services as they operate and perform today provides insight into the challenges that exist for the future. See **Figure 2-7** for the transit services in the US 29 Study Area.

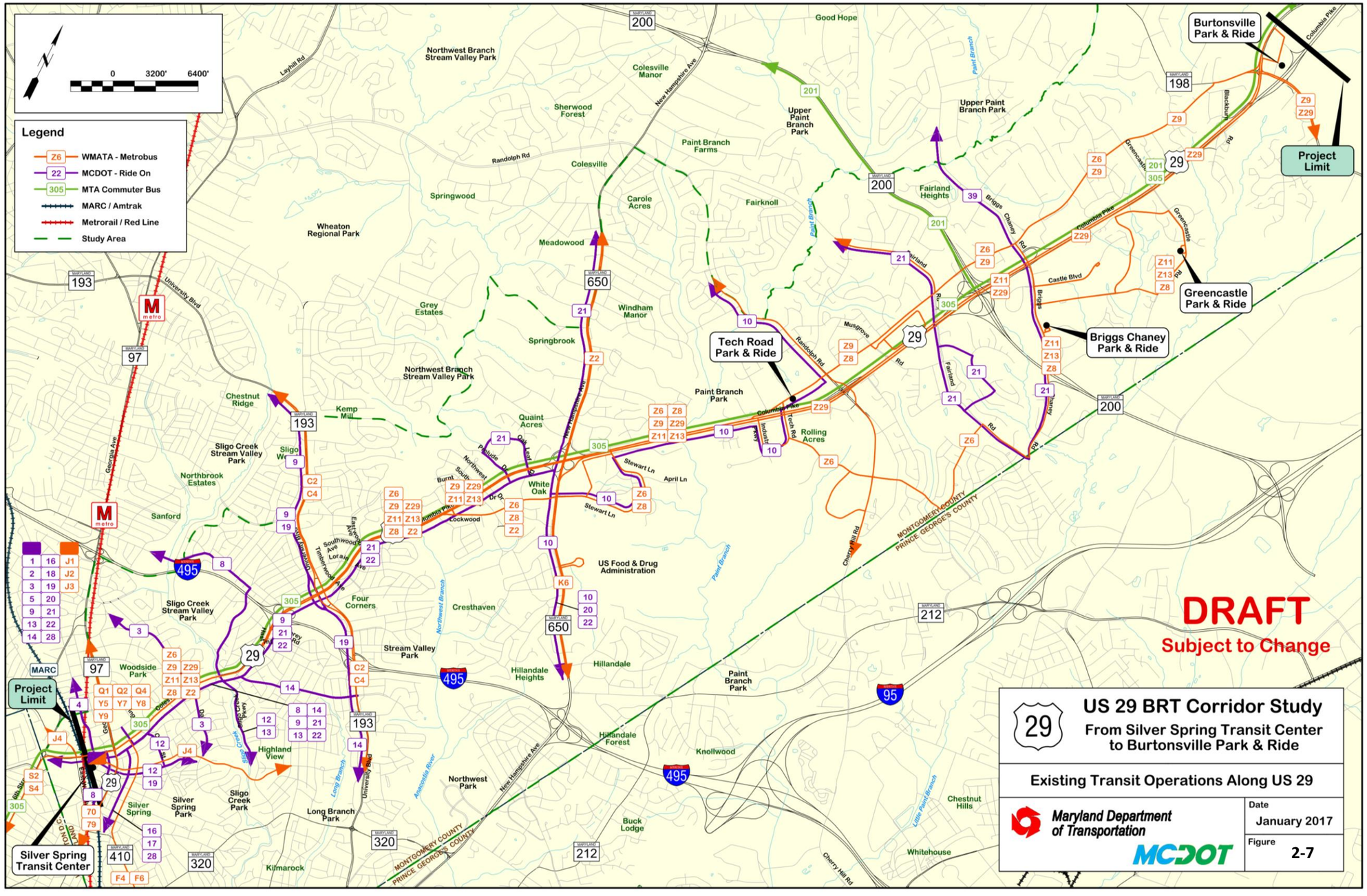
2.2.1.1 *Montgomery County Ride On Bus*

Table 2-2 provides a summary of the Montgomery County Ride On bus service that covers portions of the US 29 BRT Study Corridor Area. Four of the routes, the 8, 9, 10, and 14 generally make frequent, all day stops within the corridor and operate at headways ranging from 20-30 minutes. Routes 13, 21 and 22, operate on a limited peak period schedule with headways ranging from 25-30 minutes, providing service during weekday morning and evening peak travel times with no mid-day / off peak service.

Table 2-2: Montgomery Ride On Bus Services Summary

Bus Routes	From	To	Headway Peak	Headway Off-Peak	Span of Service
Route 8	Silver Spring Transit Center	Wheaton	25-30 min	30 min	Weekday (5:50am – 8:31pm) Saturday (7:15am – 7:46pm)
Route 9	Silver Spring Transit Center	Wheaton	20-30 min	20-30 min	Weekday (4:46am – 10:58pm) Weekend (6:30am – 9:55pm)
Route 10	Twinbrook	Hillandale	20-30 min	20-30 min	Weekday (4:39am – 11:07pm) Weekend (6:39am – 11:08pm)
Route 13	Silver Spring Transit Center	Takoma	25-30 min	n/a	Weekday (5:50am – 7:45pm) No Mid-Day Service
Route 14	Franklin Avenue	Silver Spring	25-30 min	n/a	Weekday (5:50am – 7:45pm) No Mid-Day Service
Route 21	Silver Spring Transit Center	Briggs Chaney Park and Ride	20-30 min	n/a	Weekday (5:36am – 7:58pm) No Mid-Day Service
Route 22	Silver Spring Transit Center	Hillandale	20-30 min	n/a	Weekday (5:45am – 7:25pm) No Mid-Day Service

Source: Montgomery County Ride On Data, 2015



Sources: WMATA Metrobus, Ride On, MTA.

2.2.1.2 *Metrobus*

Several Metrobus Z Line buses serve the US 29 Corridor and the rest of the Study Area. These Z-line buses are mostly weekday services, except for Z8. Several are peak services only, including Z2, Z9/Z29, and Z11/Z13. The Z2, Z6, and Z8 lines provide all day local service, while Z9/Z29 and Z11/Z13 provides limited stop express service with no off-peak services.

Most buses run on headways of six to 15 minutes, as summarized in **Table 2-3**. The Z-lines serve the area between Silver Spring Transit Center and Lockwood Drive/New Hampshire Avenue and offer a combined average service headway of 10 minutes in the a.m. peak period (6 a.m. to 9 a.m.) and six to seven minutes in the p.m. peak (4 p.m. to 7 p.m.). The combined average service headway declines farther north; 15 minutes in the a.m. and eight-and-a-half minutes in the p.m. from Lockwood Drive/New Hampshire Avenue to US 29 and Industrial Parkway, and 30 minutes north of Industrial Parkway.

The Study Corridor is a portion of WMATA's Colesville Road/Columbia corridor, which is a part of WMATA's Priority Corridor Network (PCN). WMATA has a set of strategies for improving bus service travel times, reliability, capacity, efficiency, and system access along this corridor. As part of the PCN initiative, WMATA recently conducted the Metrobus Z-line Study. The Metrobus Z-line Study made a series of short, medium, and long-term recommendations for service, bus operations, traffic operations, and passenger facility improvements. Proposed improvements ranged from modifying span of service (additional weekday and weekend service), adding stop amenities (trashcans, benches, etc.), and implementing traffic signal optimizations to providing new limited stop express service routes. More details from the Metrobus Z-line Study are available on-line at: http://www.metrobus-studies.com/Z_Line/Z_Line.html

Table 2-3: WMATA Metrobus Services Summary

Bus Routes	From	To	Headway Peak	Headway Off-Peak	Span of Service
Z2	Silver Spring Transit Center	Olney	6-15 min	n/a	Weekday (5:32am – 8:06pm) No Mid-Day Service
Z6	Silver Spring Transit Center	Burtonsville Park and Ride	6-15 min	20-30 min	Weekday (5:03am – 10:24pm)
Z8	Silver Spring Transit Center	Greencastle Park and Ride	6-15 min	20-30 min	Weekday (4:50am – 2:19am) Weekend (4:54am – 1:24am)
Z11, Z13	Silver Spring Transit Center	Greencastle Park and Ride	6-15 min	n/a	Weekday (5:18am – 8:13pm) No Mid-Day Service
Z9, Z29	Silver Spring Transit Center	Greencastle Park and Ride	6-15 min	n/a	Weekday (5:20am – 7:18pm) No Mid-Day Service

Source: WMATA Data, 2015

2.2.1.3 *Metrorail*

The Silver Spring Metrorail Red Line Station (**Figure 2-8**) is located at the south end of the Study Area. The other Metrorail stations close to the Study Area include Forest Glen, Glenmont, and Wheaton. The Red Line is the busiest Metrorail line running through downtown District of Columbia (DC) and connecting Montgomery County and downtown DC. The U-shaped Red Line alignment is approximately 31.9 miles long from Shady Grove to Glenmont and crosses perpendicular to the US 29 Study Area on the east leg of its rail alignment. As shown in **Table 2-4**, the Red Line has frequent service during the weekday rush hours, and it provides reasonably frequent services during off-peak hours and weekends. It does not, however, run through the entire Study Area.

Figure 2-8: Silver Spring Metrorail Station

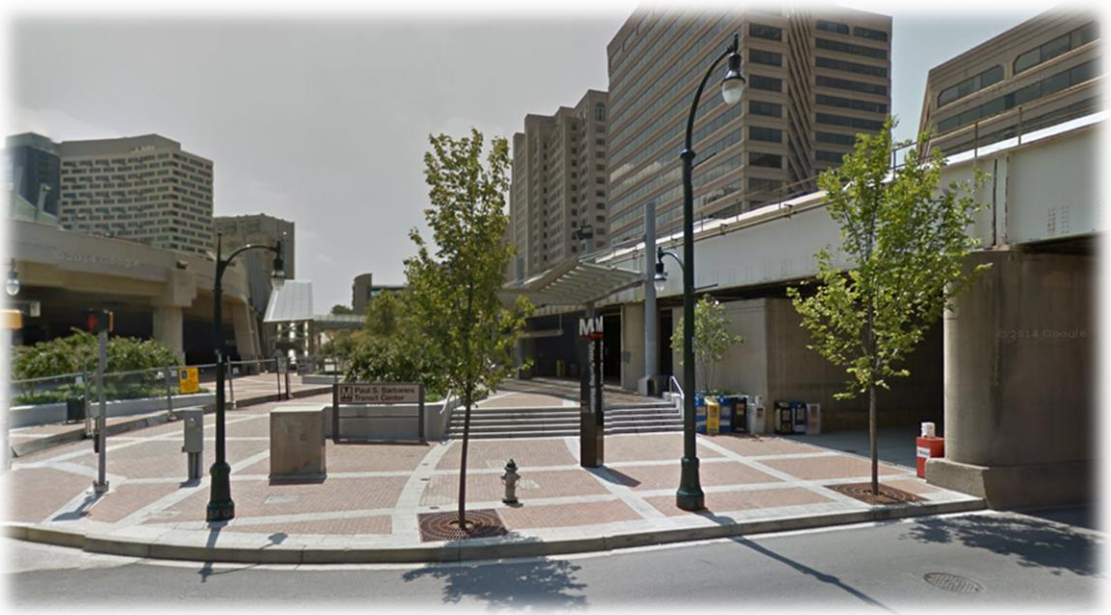


Table 2-4: WMATA Metrorail Service Summary

	Headways				
Weekday	**AM Peak**	**Midday**	**PM Peak**	**Evening**	**Late Night**
Monday to Friday	3-6 min	12 min	3-6 min	6-10 min	15-18 min
Weekend	**Daytime**			**Late Night**	
Saturday	12 min			15 min	
Sunday	15 min			15 min	

Source: WMATA Data, 2015

2.2.1.4 *MTA Commuter Services: Bus and MARC*

MTA provides commuter bus services between Columbia/Ellicott City and DC, including Routes 305, 315, and 325, as show in **Table 2-5**. These commuter buses operate in the peak direction during peak periods, with 20-minute headways. In the southbound direction, Route 305 and 315 typically pick up passengers in Howard County and at the Burtonsville Park and Ride and discharge passengers at only two locations in the Study Area – at Fenton Street, and the Silver Spring Metrorail Station. The commuter bus does not provide service for trips originating in between Silver Spring and Burtonsville. Routes 201 and 202 run on US 29 between Burtonsville Park and Ride and the Intercounty Connector (ICC / MD 200).

Table 2-5: MTA Commuter Bus Services Summary

Bus Routes	From	To	Headway Peak	Headway Off-Peak	Span of Service
Route 305	Columbia Mall	DC (Library of Congress)	About 20 min	n/a	Weekday (5:08am – 9:01am and 1:45pm - 8:13pm) No Mid-Day Service
Route 315	Lotte Plaza in Ellicott City	Silver Spring and DC (Navy Yard)	About 20 min	n/a	Weekday (5:16am – 8:47am and 3:32pm – 7:27pm) No Mid-Day Service
Route 325	Harper's Farm Village Center in Columbia	Silver Spring and DC (Library of Congress)	About 20 min	n/a	Weekday (6:26am – 8:41am and 4:05pm – 6:02pm) No Mid-Day Service
Route 201	Gaithersburg Park and Ride	BWI Marshall Airport and MARC/Amtrak Rail Station	About 60 min	About 60 min	Weekday (4:35am – 6:35pm) Weekend (4:32am – 6:32pm)
Route 202	Gaithersburg	DOT/Ft. Meade	About 60 min	About 60 min	Weekday (5:10am – 6:33pm)

Source: MTA Data, 2015

The MARC Brunswick Line provides service between DC and Martinsburg, West Virginia. Nine inbound trains stop at the Silver Spring station in the morning and nine outbound trains stop at the Silver Spring station in the afternoon and evening, Monday through Thursday. On Fridays, there is an additional outbound train. Like the Commuter Bus, the MARC trains are focused on serving daily commuters, providing limited service, in the Study Area.

2.2.1.5 *Transit Usage*

As illustrated by the figures and services described above, the Study Area has a strong transit market. The magnitude of the existing transit ridership by different modes and providers is shown in **Table 2-6**, and includes the following:

- With a daily ridership of approximately 13,200, Silver Spring Station is one of the top suburban stations for the Metrorail system. By comparison, nearby Forest Glen and Wheaton Metrorail stops serve 2,440 and 4,230 riders, respectively.

- The combined daily ridership of the Metrobus Z-line Buses, Ride On Buses, and MTA Commuter Buses totals 15,000, with approximately 11,400 on the US 29 Corridor.

- Metrobus Local services Z6 and Z8 carry the largest ridership on the US 29 Corridor, accounting for nearly 65 percent of the Metrobus ridership in the corridor.

- Transit travel patterns indicate the strongest transit market is on the southern portion of the US 29 corridor. The heaviest concentration of inbound boardings (passengers getting on buses) is within White Oak along Stewart Lane and Lockwood Drive and the heaviest concentration of inbound alightings is south of New Hampshire Avenue at Lockwood Drive. Outbound, the boardings are heavily concentrated in the line segment between Silver Spring and New Hampshire Avenue and Lockwood Drive, while the alightings (passengers getting off buses) are heavily concentrated along Stewart Lane and Lockwood Drive.

- The stops with the most boardings and alightings are between New Hampshire Avenue and Lockwood Drive and Silver Spring, and include Silver Spring Station, New Hampshire Avenue and Lockwood Drive, MD 193 (University Boulevard), and Spring Street. Other active stops include Tech Road, Castle Boulevard, the Briggs Chaney Park and Ride, and Burtonsville Park and Ride.

- Transit load profiles show a predominant concentration of transit rider volumes in the southern portion of the US 29 corridor and a large increase in loads along Stewart Lane and Lockwood Drive. Transit activity within the Study Corridor is illustrated in **Figures 2-9a and 2-9b**, below.

Figure 2-9a: 2015 Average Daily Weekday Boardings for Northbound and Southbound WMATA Stops within the Study Corridor

Source: 2015 WMATA APC data for Routes Z2, Z6, Z8, Z9/29, Z11/13

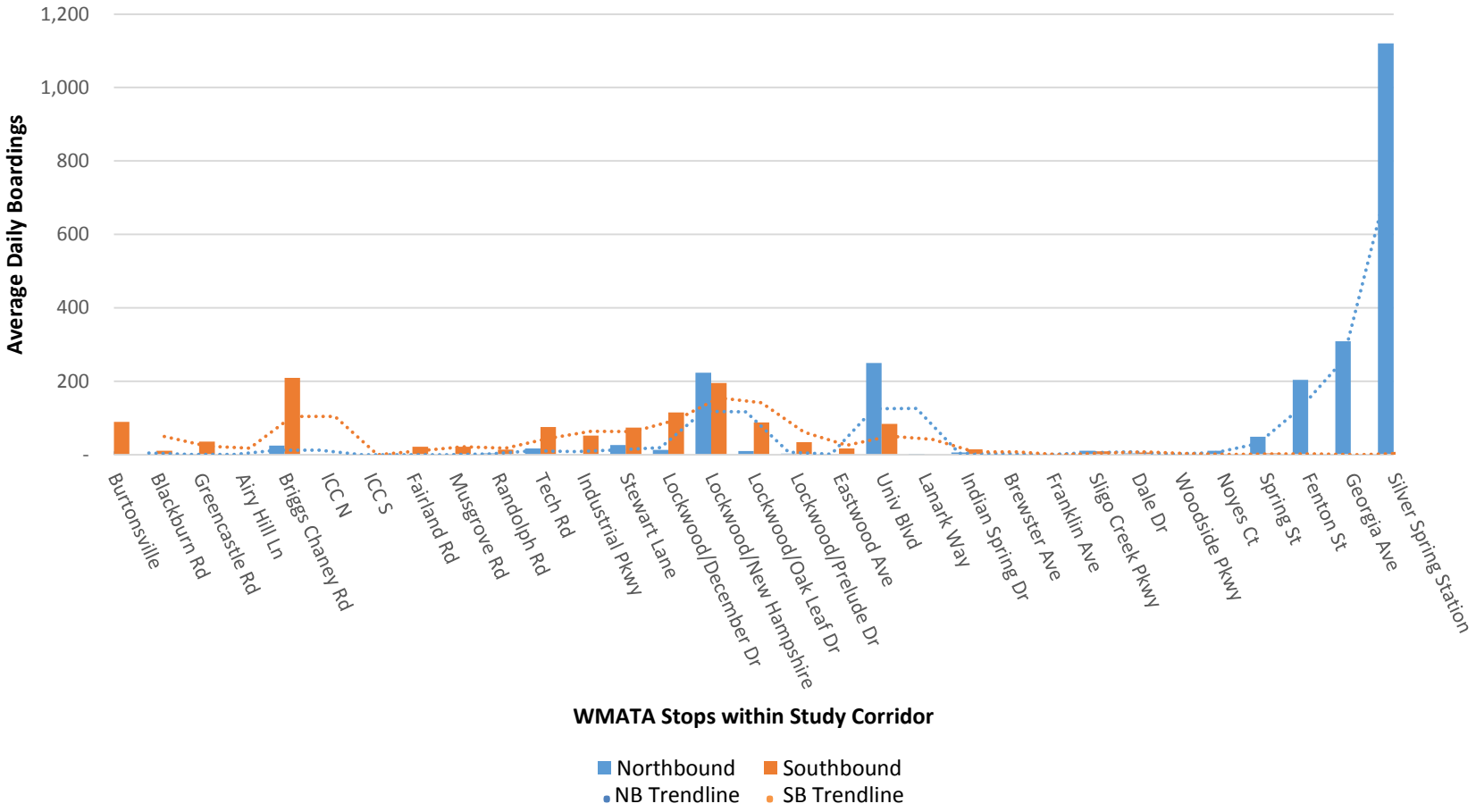


Figure 2-9b: 2015 Average Daily Weekday Boardings for Northbound and Southbound Ride On Stops within the Study Corridor

Source: 2015 Ride On data for Routes 8, 9, 10, 21, 22

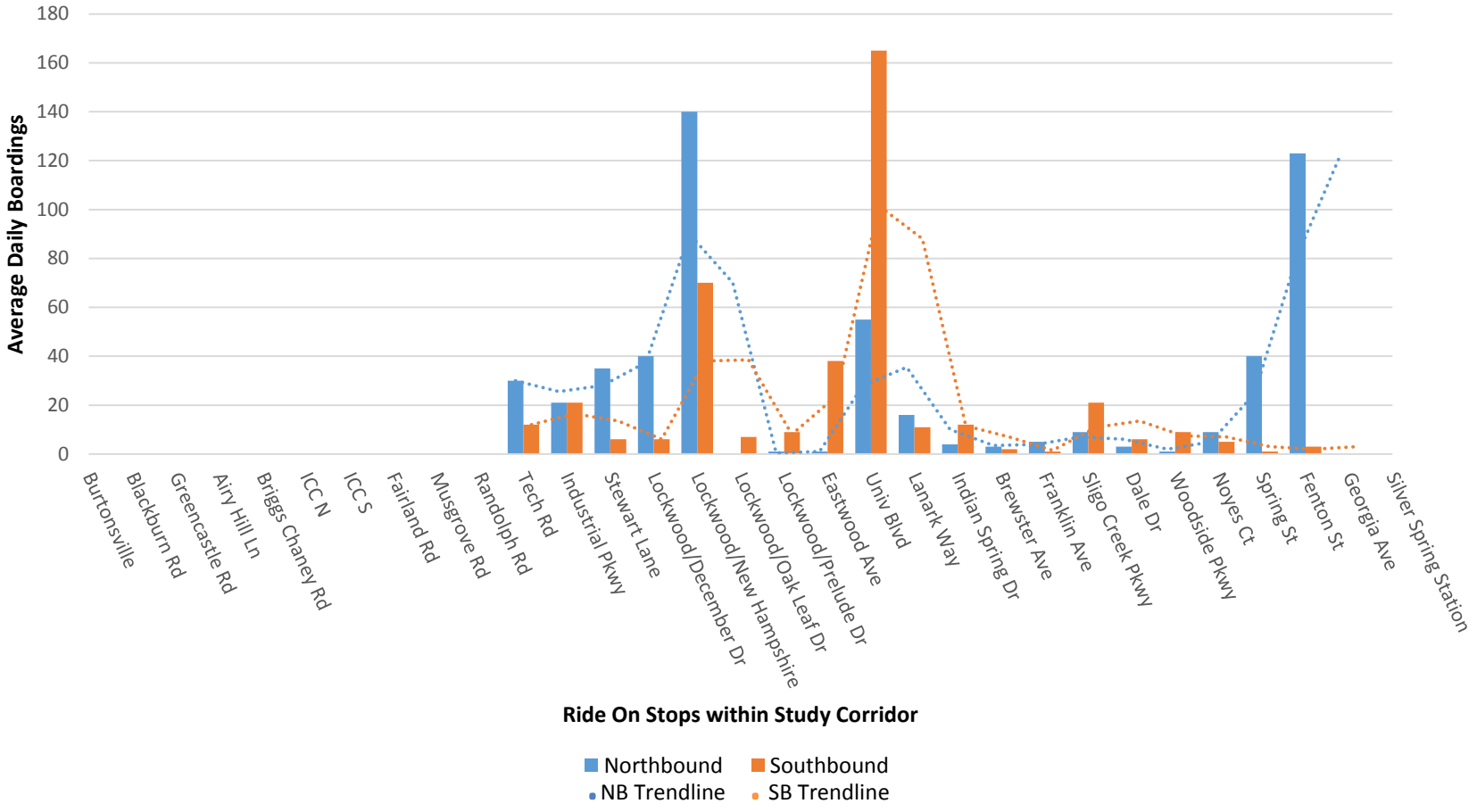


Table 2-6: Average Existing Daily Boardings

Operator	Station/Route Name	Daily Boardings
WMATA Metrorail	Silver Spring	13,200
	Forest Glen (outside study area)	*2,440*
	Wheaton (outside study area)	*4,230*
WMATA Metrobus	Z2	850
	Z6	3,330
	Z8	3,920
	Z9/29	640
	Z11/13	1,170
Montgomery Ride On	9	260
	10	350
	21	100
	22	260
MTA	201	90
	202	60
	305	160
	315	160
	325	40

Source: Metrorail: 2014 10-Year Historical Metrorail Ridership.
Metrobus: 16-JUL-14 Washington Metropolitan Area Transit Authority (WMATA) Ridership by Route and Stop.
Ride On Bus: FY13 Montgomery County US 29 Boarding and Alighting Data.
MTA: Feb 2015 MTA Average Ridership.

2.2.1.6 *Transit-Dependent Populations*

Transit dependent populations are often found in areas with lower income and minority populations. Minority populations include persons who identify themselves as Black or African-American, Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, Other, Two or More Races, or any person of Hispanic descent. Areas of low-income populations include Census Block Groups with a meaningfully greater percentage of persons living below the federal poverty level than that of a greater geographic region.

U.S. Census data is used in determining areas with significant minority or low-income populations, also referred to as potential environmental justice populations. Environmental justice is the terminology used to describe the fair treatment and meaningful involvement of all

people regardless of race, faith, national origin, or income with the respect to development, implementation, and enforcement of environmental laws, regulations, and policies.

Consistent with MDOT/SHA's guidelines, potential environmental justice lower income areas are Block Groups with the percentage of persons living below poverty greater than or equal to that of Montgomery County. Potential environmental justice minority populations are Block Groups with a meaningfully greater percentage of minorities than the averages located within Montgomery County. (See **Figure 5-7** later in this document for details)

Based on the 100 percent count data from the 2010 U.S. Census, 48 of the 99 Block Groups within the project vicinity have potential environmental justice populations. Based on the 2009-2013 U.S. Census American Community Survey Estimates, 19 of the 99 Block Groups are potentially low-income populations. The Block Groups with potential minority populations are concentrated immediately along either side of US 29, north of New Hampshire Avenue (MD 650), as well as the southern portion of the Study Area near downtown Silver Spring. The Block Groups with potential low-income populations are dispersed throughout the Study Area with the only concentration just northeast of the US 29 / ICC (MD 200) interchange.

Twelve percent of the study area population is 65 or over and 23 percent of the population is under 18 years old. Six percent of the Study Area's population is disabled. Silver Spring, White Oak, and Fairland communities have populations with 10 percent of the population disabled. Twelve percent of the households in the study area do not have access to a personal motor vehicle. (See **Figure 3-1** later in this document for more details)

2.3 Existing Roadway Conditions and Traffic Operations

2.3.1 Roadway Characteristics

The roadway classification of US 29 changes from a principal arterial with traffic signals in the southern portion of the BRT corridor around Silver Spring and White Oak to a limited-access highway in the northern portion of the BRT corridor around Fairland and Burtonsville.

The typical cross section along the US 29 corridor varies between four-lane, five-lane, and six-lane sections with additional turn and merge / diverge lanes. A reversible-lane segment extends approximately one mile from the MD 97 (Georgia Avenue) intersection to just south of the Sligo Creek Parkway intersection. This section, south of Sligo Creek Parkway, is undivided, while the section north of Sligo Creek Parkway is divided using a combination of curb and grass medians, with breaks at intersections along the US 29 corridor.

Figure 2-10a: US 29 at Wayne Ave/2nd Street Looking North

Figure 2-10b: US 29 at Fenton Street Looking North

Figure 2-10c: US 29 at Sligo Creek Parkway Looking North

Figure 2-10d: US 29 at MD 193 Looking North

Figure 2-10e: US 29 at Cherry Hill Rd/Randolph Rd Looking North

Figure 2-10f: Lockwood Drive at Oak Leaf Drive Looking North

Along the US 29 BRT Study Corridor, there are six interchanges, 23 signalized and 22 unsignalized intersections, and numerous driveways. Some segments of the roadway include shoulders, medians, sidewalks, and curb and gutter that vary in design and utilization along the route. Utility poles and light poles are scattered throughout the corridor.

Along Briggs Chaney Road / Castle Boulevard, there are five signalized and on unsignalized intersections, and numerous side street and driveway access points. Most of Briggs Chaney Road is four lane divided, closed section roadway, with posted speed limits of 35 mph. Castle Boulevard is a two lane undivided, closed section roadway with a center turn lane and posted speed of 30 mph.

Along the Lockwood Drive/Stewart Lane segment, there are two signalized and 15 unsignalized intersections, and numerous driveways. This does not include the two intersections at US 29 / Lockwood Drive and US 29 / Stewart Lane that were counted in the section above. Some segments of this roadway also include shoulders, sidewalks, and curb and gutter. Street parking is present in the northbound and southbound directions along Lockwood Drive and Stewart Lane where shoulders are provided. Utility and light poles are located within the right-of-way. South of MD 650, US 29 has posted speeds of 30 to 45 mph. North of MD 650, US 29 has posted speeds of 45 to 55 mph. The posted speed limit along the Lockwood Drive/Stewart Lane segment is 30 mph.

Four overpasses cross over US 29. Three are grade-separated roads and one is a rail line (see **Figure 2-1** above). These four overpasses have column support structures in the median of US 29. In addition, three grade-separated roads pass under US 29. All intersections along the Lockwood Drive/Stewart Lane corridor are at-grade.

2.3.2 Existing Structures Inventory and Condition Summary

SHA inspection reports and plans for 17 bridge structures were reviewed to determine if there are any potential concerns for utilizing existing inside or outside shoulders as a dedicated BRT lane. In general, the Study Team found that none of the structures have any load restrictions and many issues identified in the inspection reports are minor and are to be resolved with repairs as part of regular maintenance efforts. If dedicated BRT lanes/shoulders are ultimately pursued, additional studies may be required to determine whether a proposed dedicated BRT lane would result in the addition of a designated traffic lane on the bridge or whether modification of the shoulders could negatively impact the vertical clearance under a bridge or the slope of the roadway embankment. The structures reviewed are listed below. (All bridge numbers with an 'X' are pipe structures):

- Bridge No. 150189X01 – US 29 over Drainage Ditch; year built unknown
- Bridge No. 150190X01 – US 29 over Tributary (Trib) to Little Paint Branch; year built unknown
- Bridge No. 150191X01 – US 29 over Trib to Little Paint Branch; built in 1956
- Bridge No. 150192X01 – US 29 over Trib to Little Paint Branch; built in 1956
- Bridge No. 150265X01 – US 29 & RPS PA; MC over Drainage Ditch; built in 2004
- Bridge No. 150399X01 – US 29 over Drainage Ditch; built in 2003
- Bridge No. 1500900 – US 29 over Northwest Branch; built in 1920, widened in 1931 and 1961
- Bridge No. 1501000 – US 29 over Sligo Creek; built in 1936 ,widened in 1972
- Bridge No. 1506700 – US 29 over MD 650; built in 1954, re-decked in 1982 and 1994
- Bridge No. 1507601 – US 29NB over Paint Branch; built in 1957, re-decked in 1990
- Bridge No. 1507602 – US 29SB over Paint Branch; built in 1957, re-decked in 1990
- Bridge No. 1513500 – US 29 over I-495; built in 1959, reconstructed in 2004
- Bridge No. 1518100 – MD 29A over US 29 Ramp E; built in 2006
- Bridge No. 1518301 – US 29NB over MD 198; built in 2002
- Bridge No. 1518302 – US 29SB over MD 198; built in 2002
- Bridge No. 1518600 – Briggs Chaney Road over US 29; built in 2007

2.3.3 Roadway Operations

The US 29 BRT Study Corridor is approximately 10 miles in length with an additional 2-mile segment of BRT along Lockwood Drive / Stewart Lane, and a 2-mile segment on Briggs Chaney Road / Castle Boulevard. The Average Daily Traffic (ADT) along the US 29 Study Corridor ranges from 39,600 vehicles south of Fenton Street to 79,400 vehicles north of Crestmoor Drive. The peak direction of traffic flow is southbound during the AM peak and northbound in the PM peak.

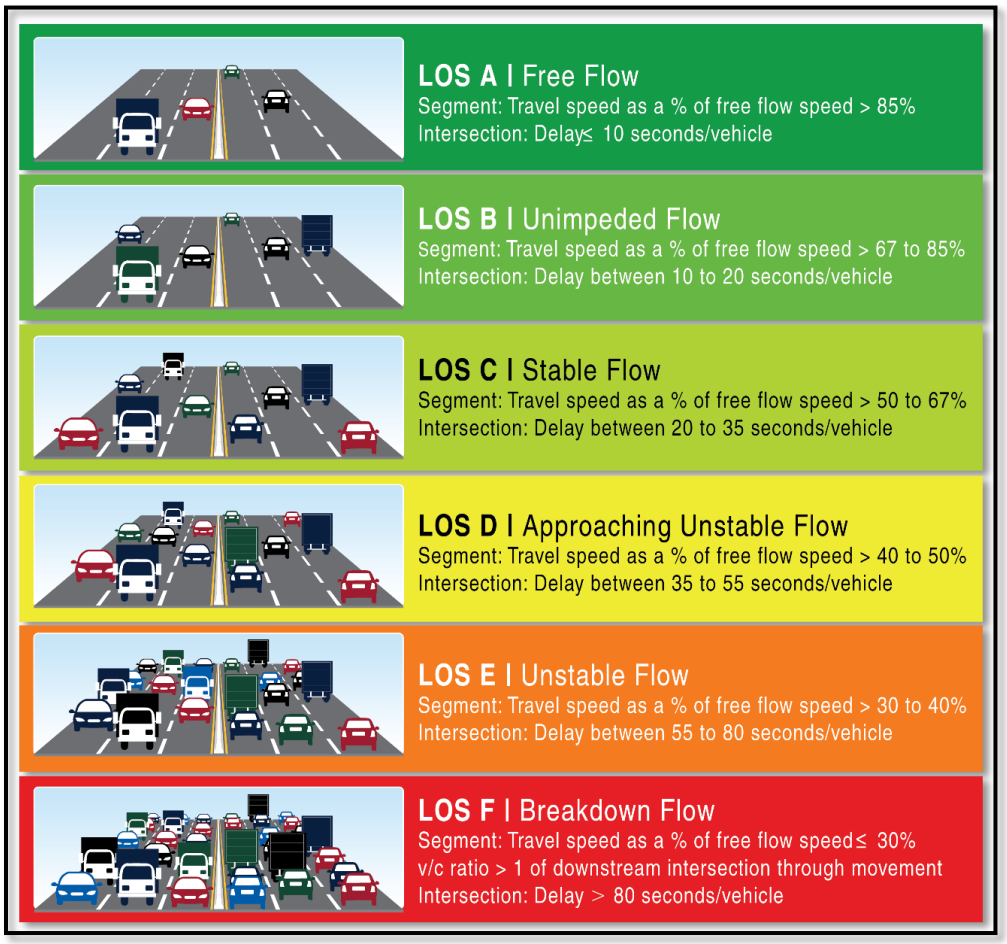
2.3.4 Roadway Congestion and safety

Roadway congestion presents a daily reminder of the high levels of activity that define this corridor, and the congestion is anticipated to worsen as growth and economic development continue to expand in the corridor and the region. Several roadway sections in the US 29 corridor exceed their volume to capacity ratio to the point that they are considered as "unstable and Breakdown flow" sections. There are six roadway sections that operate at Level of Service[2] (LOS) F and nine that are at LOS E (See **Figure 2-11** below, for more details on

[2] Level of Service is a traffic analysis tool used to communicate the operational integrity of roadway segments and intersections. Similar to school grading systems, LOS grade of A through C are considered acceptable operations with little to no delay. Grades of D, E, and F are signs of poor traffic operations that show potentially long delays and congestion.

existing LOS). These grades represent very poor existing traffic operations for the corridor that lead to extended and more variable travel times and vehicles detouring to other facilities.

Figure 2-11: Level of Service Grades A to F – Shows How Intersections and Roadway Segments are Graded Based on Operational Capacity to Process Traffic Demand



The US 29 corridor is characterized by variable traffic volumes and associated congestion (depending on location within the corridor) that hinders bus mobility and results in unpredictable service and travel times. This is especially true in the southern section near downtown Silver Spring, which has a denser urban fabric and narrower right-of-way. This congestion also frequently causes existing Metrobus and Ride On bus services on US 29 to operate behind schedule.

Table 2-7 below shows the existing 2015 ADT along the corridor at major crossroads.

Table 2-7: Existing 2015 ADT

Roadway Sections (North to South)	2015 Existing ADT (vehicles/day) *Lowest - Highest*
Sandy Spring Road (MD 198) to Cherry Hill Road/E. Randolph Road	70,900 – 73,700
Cherry Hill Road/E. Randolph Road to New Hampshire Avenue (MD 650)	59,800 – 71,600
New Hampshire Avenue (MD 650) to University Boulevard (MD 193)	65,500 – 79,400
University Boulevard (MD 193) to Capital Beltway (I-495)	74,000
Capital Beltway (I-495) to Georgia Avenue (MD 97)	39,600 - 65,200

Source: 2015 Existing Data from Vehicle counts.

A preliminary review of the corridor congestion was collected from the Regional Integrated Transportation Information System (RITIS) for the two selected peak hours, 8:00-9:00 am and 5:00-6:00 pm, and averaged over the entire 2015 year for a typical Tuesday, Wednesday, and Thursday. Shown below in **Figures 2-12 and 2-13** provides peak hour Travel Time Indices (TTI) for the morning and afternoon peaks.

TTI refers to the travel time as a percentage of the ideal travel time. This means the actual travel time under congested conditions is divided by the free-flow travel time for an estimate of the proportional time increase. In other words, TTI value of 2 means it will take twice as long to travel through the segment compared to the free flow conditions. Note that the color designations on the TTI maps shown below do not represent LOS, which will be shown in later sections of this report.

Figure 2-12 shows congestion concerns for US 29 southbound in the morning peak hour, starting from Cherry Hill Road/E. Randolph Road and extending to MD 193 with a 2.5 TTI. Additionally, **Figure 2-13** shows traffic approaching Silver Spring downtown area experiences some delays, in both northbound and southbound directions.

In the afternoon peak hour, congestion delays were noted throughout the US 29 corridor. The average congestion appears to be above a 1.3 TTI (yellow) with only spot locations operating between 0-1.3 TTI (green). The southbound direction of US 29 in Silver Spring also operates poorly while the northbound US 29 corridor has a larger number of segments above 1.6 TTI (orange and red). More details on TTI calculations are provided in the ***US 29 BRT Draft Preliminary Purpose and Need Document (December 2015)***.

Figure 2-12: 2015 Morning Peak Hour Congestion Map in TTI

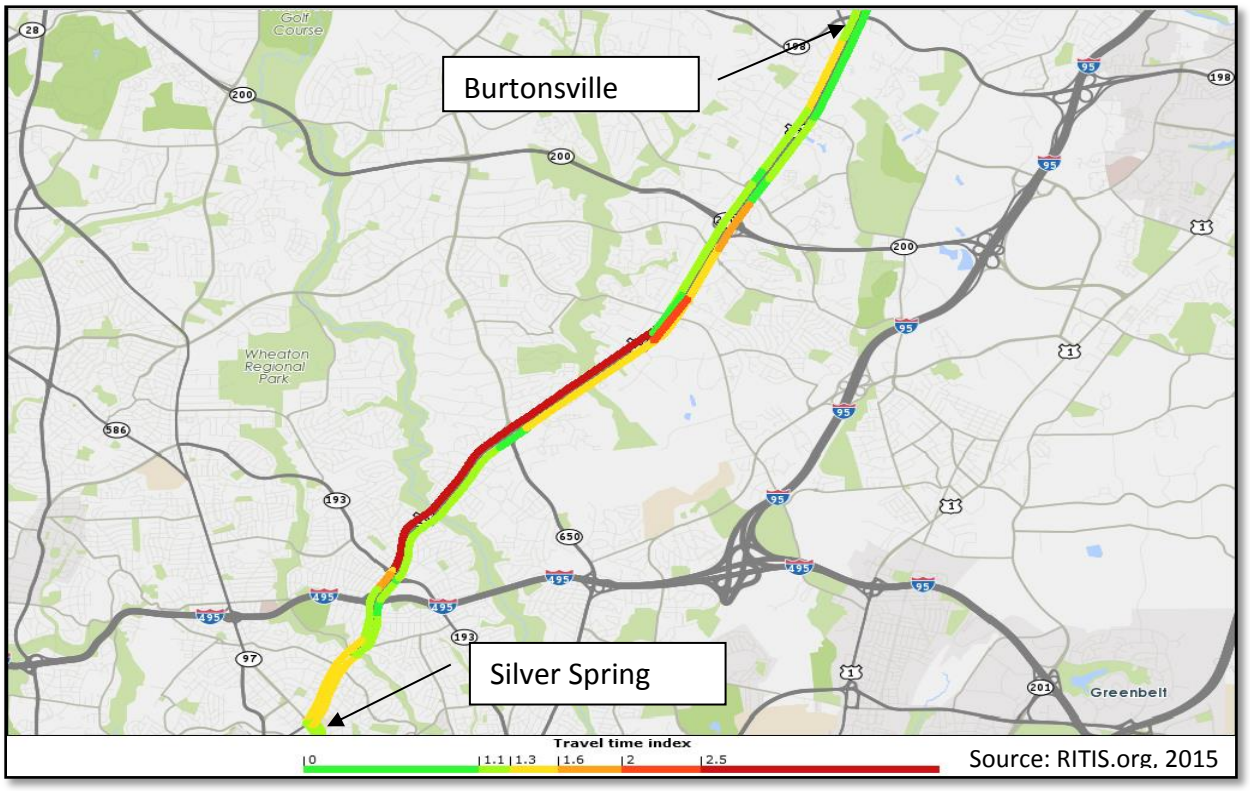
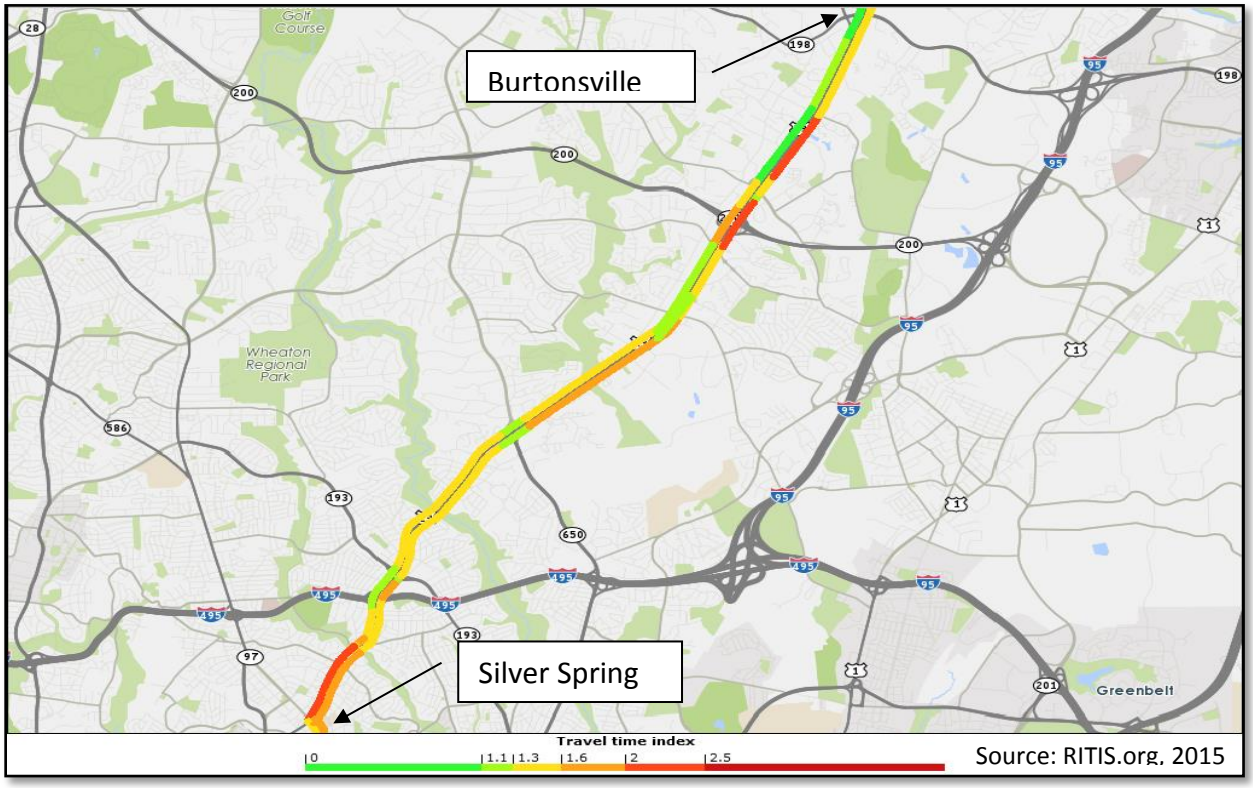


Figure 2-13: 2015 Afternoon Peak Hour Congestion Map in TTI



2.3.5 Existing Intersection Level of Service

Intersection LOS is calculated based on approach vehicular delays and is measured in seconds of delay per vehicle (sec/veh). The approach delays are weighted based on vehicular volumes and added to provide a total intersection delay, which is then translated to a LOS grade based on the latest 2010 Highway Capacity Manual (HCM).

As summarized in **Table 2-8**, a review of the US 29 operational results indicates that two intersections operate at LOS F, defined as delay greater than 80 sec/veh, under existing 2015 conditions: one in the AM peak hour (Tech Road) and one in the PM peak hour (MD 650 at Lockwood Dr). Additionally, four intersections operate at LOS E with delays between 55 and 80 sec/veh), one in the AM peak hour (Greencastle Rd) and three in the PM peak hour (Dale Dr, Briggs Chaney Rd at Castle Blvd, and MD 198 at Old Columbia Pike). This happens in the PM peak hour for three out of the four intersections (see ***US 29 BRT Draft Preliminary Purpose and Need (December 2015)*** for more details).

Table 2-8: Existing 2015 Intersection LOS

US 29 Mainline Intersections (*Associated Side-street Intersections*)	2015 AM		2015 PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
US 29 at Bonifant St	6.7	A	14.4	B
US 29 at Wayne Ave	24.2	C	32.9	C
Colesville Rd at Wayne Ave/2nd Ave	36.6	D	53.6	D
US 29 at Fenton St	15.0	B	26.8	C
US 29 at Spring St	26.0	C	44.2	D
US 29 at Dale Dr	23.9	C	70.4	E
US 29 at Sligo Creek Pkwy	30.5	C	44.0	D
US 29 at Franklin Ave	18.6	B	14.2	B
US 29 at MD 193 (South)	32.4	C	35.9	D
MD 650 at Lockwood Dr	51.7	D	**145.5**	**F**
US 29 at Stewart Ln	14.3	B	20.5	C
US 29 at Industrial Pkwy	15.6	B	48.1	D
US 29 at Tech Rd	**87.4**	**F**	42.8	D
US 29 at Randolph Rd	39.4	D	40.6	D
Randolph Rd at Old Columbia Pike	32.1	C	29.0	C
Fairland Rd at Old Columbia Pike	44.3	D	37.2	D
Briggs Chaney Rd at Castle Blvd	34.4	C	57.4	E
US 29 at Greencastle Rd	72.5	E	48.8	D
US 29 at MD 198	20.8	C	35.2	D
MD 198 at Old Columbia Pike	40.8	D	67.9	E
Old Columbia Pike at National Dr	4.3	A	11.7	B

Source: SHA, 2015 Existing Data from Vehicle counts.

2.3.6 Crash rates

Coinciding with high levels of roadway congestion, corridors like US 29 often experience safety issues. There is evidence that congested roadways frequently experience higher than average crash rates than similar types of facilities that are less congested.

The segment of US 29 between MD 97 and Spring Street was identified as having a crash rate significantly higher than statewide average for similar state-owned roadways. A total of 1,088 crashes were reported along the US 29 corridor during the three-year study period from 2011 to 2013. Three (3) crashes resulted in three (3) fatalities. Four hundred forty-seven (447) of the crashes resulted in injuries to 649 vehicle occupants. There were 24 incidents involving pedestrians and/or bicyclists. Additional details related to reported crashes along US 29 are provided in **Table 2-9**.

Table 2-9: US 29 Crash Data Summary

Roadway Sections (North to South)	3-year Crash Rate per Mile	Primary Crash Types
MD 97 to Spring Street Includes portions of US 29 south of MD 97	200 (above statewide average for similar facilities)	Sideswipe, pedestrian, property damage, & parked vehicles
Spring Street to MD 193 (University Boulevard)	182	Rear end & Sideswipe
MD 193 (University Boulevard) to Lockwood Drive	117	Opposite Direction
Lockwood Drive to Stewart Lane	103	Injury, Left Turn & Night time
Stewart Lane to Musgrove Road	95	Injury, Left Turn, Angle, & Night Time
Musgrove Road to MD 198 (Sandy Spring Road)	64	Night Time

3 Preliminary Purpose and Need

3.1 Identified Corridor Problems and Issues

This chapter identifies the existing and future transportation needs in the US 29 Study Area that a BRT project could potentially address. The Study Team has designated the Purpose and Need as preliminary. It is intended to provide the initial foundation for the official, agency supported, Purpose and Need statement as the project moves into a future development phase as part of the federal National Environmental Policy Act (NEPA) approval process. For more details please see the Draft Preliminary Purpose and Need document.

Four specific preliminary needs for the corridor and Study Area have been categorized as the following, based on the problems and issues identified later in the chapter:

- *Transit demand and attractiveness* – Transit demand and ridership in the US 29 corridor continues to increase. There is evidence of demand for a high-quality transit service to retain current transit riders and attract new riders.
- *Mobility* – Traffic congestion currently impedes bus and rider mobility and results in unpredictable bus service, longer travel times, and delayed schedules. Corridor-wide enhancements may address efficiency and reliability and could potentially improve mobility for transit riders.
- *System connectivity* – A high-quality, continuous transit service from Silver Spring to Burtonsville that can support the surrounding mixed used development along the corridor is largely absent to connect transit customers to local and regional employment and activity centers.
- *Livability* – Transit improvements are needed throughout the US 29 corridor to create a transportation network that enhances choices for transportation users and promotes positive effects on the surrounding communities and residents' quality of life.

3.1.1 Problems and Issues

Based upon the analysis and input from elected officials, county planners, local residents and travelers, the Study Team has identified the following transportation challenges and issues in the US 29 corridor:

- Limitations in existing transit service and its appeal to the public;
- Transit demand and dependency and growing transit market;
- Limited connectivity for pedestrians and bicyclists; and
- Planned growth and development within the Study Area.

These factors establish the basis of the needs for transit-related enhancements and ultimately define the purpose of this study.

3.2 Preliminary Purpose Statement

"The purpose of this project is to improve mobility options by accommodating a high frequency, reliable transit service operating within existing right-of-way to the extent practical between the Silver Spring Transit Center and the Burtonsville Park & Ride with service commencing as quickly as possible."

The preliminary purpose statement translates into the following distinct goals to guide the development of alternatives and as a performance evaluation measures for comparing alternatives:

- Enhance transit connectivity and multi-modal integration along the corridor as part of a coordinated regional transit system;
- Accommodate enhanced, efficient, high frequency, reliable transit service;
- Provide a sustainable and cost effective transit solution;
- Support approved Master Planned residential and commercial growth along the corridor by providing access to transit;
- Address current and future bus ridership demands;
- Attract new riders and provide improved service options for existing riders as an alternative to congested automobile travel through the corridor;
- Improve transit access to major employment and activity centers by connecting more jobs and people within 45 and 60 minutes of the activity centers;
- Utilize existing right-of-way to the extent possible to minimize property and environmental impacts; and
- Commence as quickly as possible.

3.3 Preliminary Needs Identification

3.3.1 Limitations in Existing Transit Service and its Appeal to the Public

Despite strong transit demand, existing corridor bus service is not attractive due to slow travel speeds, high delay, poor connectivity, unreliable service, and limited pedestrian and bicycle access.

A review of current services reveals that the MTA 305, 315, and 325 Commuter Buses and the Metrobus Z29 do not serve the entire corridor. Specifically, the MTA Commuter buses only serve limited stop locations during peak AM and PM hours (stops at Burtonsville, Fenton Street, and Silver Spring), and Z29 limits riders from boarding/alighting between Blackburn and Spring Street, with the exception of Oak Leaf Drive, Prelude Drive, and University Boulevard. Other Z-

line routes serve most of the corridor but have service gaps north of the Tech Road Park and Ride with routes deviating from the US 29 corridor. MCDOT Ride On service is fairly consistent from Silver Spring to Randolph Road but does not extend north of that location. Unlike the southern portion of the corridor, which has a robust transit service, the northern portion of the corridor is not as well served by transit.

The Metrobus Z-line provides service from Silver Spring to the Burtonsville Park and Ride. Like all other vehicles, the Z-line buses experience delays due to traffic congestion that causes vehicles to queue or sit through multiple traffic signal cycles at intersections throughout the corridor. Similar issues are present along Lockwood Drive and Stewart Lane.

Currently, there are lags in service that make it harder for users to utilize different transit options to travel the corridor. The WMATA Z-line Study offered the following potential short-term operational changes to address these service issues (these changes were implemented in March 2016):

- **Z6**: Improve weekday schedule reliability
- **Z6**: Add Saturday service between Silver Spring Transit Center and Castle Boulevard
- **Z8**: Reduce Saturday frequency to coordinate with new Z6 trips for added frequency on overlapping portions of routes Z6 and Z8
- **Z9, Z29**: Restructure service, combine with Z11, Z13
- **Z11, Z13**: Restructure service, combine with Z9, Z29

General reliability issues (adherence to schedule, bus bunching, slow travel times) create undesirable levels of service for all riders, but especially for those individuals who rely on public transit as their primary mode of transportation. Furthermore, the issues associated with the current bus service make less attractive to individuals with access to alternate transportation options who might otherwise elect to take the bus if it offered comfort, reliability, and convenience.

Another issue with existing bus services, which is generally true of all non-BRT bus systems, is the use of onboard fare collection, which is an added source of delay. Fares are usually taken as riders board the bus through one access point. This adds to dwell time which is the time the bus stays at the bus stop to allow for boardings, making the bus a less appealing travel option for those who have other travel options. Also, congestion in the roadway, particularly during peak hours, affects the frequency of buses as they progress slowly through the congested corridor. Longer wait times cause a greater number of passengers to gather at a bus stop. When a large group of passengers boards a bus at one time, fare collection takes longer, buses

are further delayed, and on-time performance is affected due to the increased dwell time at these stops.

Other contributors to inefficient bus service are closely spaced bus stops, inefficient pedestrian movements, delays at poorly operating signalized intersections, and merging movements into and out of traffic at stops. Current bus speeds along US 29 (developed from field verified data collection efforts) vary from 8 mph to 54 mph as shown in **Table 3-1**. Bus speeds are calculated directly from the travel times and thus include the dwell times at each stop.

Table 3-1: Existing 2015 Average Daily Bus Peak Hour Speeds

US 29 Northbound	2015 AM Peak Hour (mph)	2015 PM Peak Hour (mph)
MD 97/Georgia Ave to Dale Dr	14	11
Dale Dr to Sligo Creek Pkwy	12	14
Sligo Creek Pkwy to Franklin Ave	24	19
Franklin Ave to I-495 EB Ramp	34	33
I-495 EB Ramp to I-495 WB Ramp	39	37
I-495 WB Ramp to EB MD 193	21	12
EB MD 193 to WB MD 193	33	33
WB MD 193 to MD 650 SB Ramp	33	29
MD 650 SB Ramp to MD 650 NB Ramp	42	35
MD 650 NB Ramp to Fairland Rd	32	25
Fairland Rd to Briggs Chaney Rd	51	44
Briggs Chaney Rd to Greencastle Rd	34	28
Greencastle Rd to Blackburn Rd	43	44
Blackburn Rd to MD 198	54	54
US 29 Southbound	**2015 AM Peak Hour (mph)**	**2015 PM Peak Hour (mph)**
MD 198 to Greencastle Rd	17	40
Greencastle Rd to Briggs Chaney Rd	52	49
Briggs Chaney Rd to Fairland Rd	43	31
Fairland Rd to MD 650 NB Ramp	19	36
MD 650 NB Ramp to MD 650 SB Ramp	8	42
MD 650 SB Ramp to WB MD 193	12	26
WB MD 193 to EB MD 193	23	15
EB MD 193 to I-495 WB	36	29
I-495 WB Ramp to I-495 Exit Ramp	38	39
I-495 Exit Ramp to Franklin Ave	26	29
Franklin Ave to Sligo Creek Pkwy	16	8
Sligo Creek Pkwy to Dale Dr	20	11
Dale Dr to MD 97/Georgia Ave	19	12

Source: SHA and MWCOG/TPB

According to the recent WMATA Z-Line Study, the existing transit services in the US 29 corridor is hindered by bus overcrowding, lengthy waiting and dwell times, and overall reliability issues.

Based on current travel times and speeds, buses along the corridor take up to over 20 percent longer on average than automobile trips, reaching as high as 60 percent longer in certain segments. These existing service issues illustrate how buses have limited ability to provide an appealing competing option to single occupant vehicles. In addition, the latest on-time performance evaluations indicate a 66 percent on-time performance for the most heavily utilized bus route in the corridor (WMATA Z8), with average travel speeds between eight and 18 miles per hour during the peak-hours in the most urbanized sections of Silver Spring. **Tables 3-2a and 3-2b** provide a summary of anticipated changes in corridor-wide average travel times and speeds between existing 2015 conditions and the 2040 No-Build conditions. **Table 3-3** provides a summary of on-time bus performance. It is anticipated that 2040 travel times will increase by a total of 13 minutes in the morning and 14 minutes in the evening peak hours.

There is a great potential for increasing the transit share in the Study Area, but achieving such a goal requires higher-quality transit service.

Table 3-2a: Existing 2015 vs. 2040 No-Build Average Travel Times

	Southbound (end-to-end)			Northbound (end-to-end)		
	2015 Existing	2040 No-Build	Percent Increase	2015 Existing	2040 No-Build	Percent Increase
AM Cars & Trucks	34 min	45 min	32%	21 min	21 min	0%
AM Buses*	34 min	47 min	39%	25 min	25 min	0%
PM Cars & Trucks	23 min	25 min	9%	25 min	37 min	48%
PM Buses*	27 min	30 min	11%	30 min	44 min	47%

*This percent increase does not affect buses individually; it is a network-wide bus miles traveled comparison.

Table 3-2b: Existing 2015 vs. 2040 No-Build Average Speeds

	Southbound (end-to-end)			Northbound (end-to-end)		
	2015 Existing	2040 No-Build	Percent Difference	2015 Existing	2040 No-Build	Percent Difference
AM Cars & Trucks	21 mph	16 mph	27%	32 mph	33 mph	3%
AM Buses	20 mph	17 mph	16%	21 mph	21 mph	0%
PM Cars & Trucks	29 mph	29 mph	0%	27 mph	22 mph	20%
PM Buses	23 mph	22 mph	4%	27 mph	24 mph	12%

Table 3-3: Existing 2015 On-Time Bus Performance

Bus Service	On-Time Performance
Weekday AM	81%
Weekday PM	49%
Weekday Midday	68%
Weekend AM	90%
Weekend PM	82%
Weekend Midday	79%

Source: WMATA and Ride On

3.3.2 Transit Demand and Dependency and Growing Transit Market

Twelve percent of metropolitan DC area households are without a private vehicle and rely on transit, as do many low-income, disabled and elderly corridor residents. Some young adults are also seeking independence from private vehicle ownership and instead, would like multi-modal options.

There is a great potential for increasing the transit share in the Study Area, but achieving such a goal requires higher-quality transit service. Currently, the transit share for all trip purposes in the corridor is ten percent, which is higher than the transit share in Montgomery County on average. Single-occupant vehicles are the primary travel mode for all trip purposes, accounting for almost 46 percent of all trips in the Study Area in 2014. For Home-Based Work (HBW) trips, transit plays an important role, with about 35 percent of modal share in the Study Area. For Home-Based Non-Work (HBNW) and Non Home-Based (NHB) trips, transit only accounts for about three percent and four percent of trips, while high-occupant vehicle shares for those trips are respectively 56 percent and 45 percent.

As identified in the Countywide Bus Rapid Transit Study (2011) and in the CTCFMP (2013), Montgomery County seeks to enhance the existing and planned transit and transportation options throughout the County. In order to maintain or improve transit modal share, a higher quality of transit service is needed to attract new transit riders, including those who would regularly drive between points along the Study Corridor, or those who would benefit from longer trips and fewer stops, as offered by BRT. Generally, riders are attracted to transit service when travel times are reduced, reliability is increased, and they feel comfortable and safe.

Despite some existing transit service issues, there is a growing market for a BRT service that is competitive with auto travel. Based on projected 2040 growth in population (13 percent), households (17 percent), and employment (78 percent), and anticipated increase in daily trip productions (13 percent) and attractions (43 percent), the numbers show a potential increase in transportation demands. Combine these demographic and travel demand growth metrics with the anticipated growth in transit usage (seven percent) and planned mixed use developments, and there is strong evidence for a growing market for transportation facilities and services that could be served by BRT. The Study Team is considering the following factors, farmed from 2010 Census Data and other surveys referenced in this document, as evidence of a growing market for enhanced transit services:

- Five percent of Study Area households are below the poverty level;
- Six percent of the Study Area's population is disabled. Silver Spring, White Oak, and Fairland communities have populations with ten percent of the population disabled;
- Twelve percent of the Study Area's population is 65 years and older, and 34 percent is 40 to 64 years old;
- Sixty-five percent are minority, 32 percent foreign born, and 31 percent over the age of five speak a language other than English;
- Research shows many young adults (millennials) are looking for locations to live and work that offer reliable multi-modal options; and
- Almost 12 percent of households in the study area do not have access to a personal motor vehicle; and more than 37 percent of households in the study area own a single motor vehicle.

The above data summaries provide evidence that there is a current and potentially growing need for transit services in the region and within the Study Area for those who do not currently own a private vehicle (see **Figure 3-2)**. While anticipated growth in employment may decrease the number of households living below the poverty level, there is a significant population within the Study Area that is aging and may require transit services. By providing improved

connectivity and mobility through premium transit services, these transit-dependent populations may be better served.

In addition, according to recent reports by the American Public Transportation Association (APTA)[3], millennials (those born between early 1980s and early 2000s – or today's young adults) are looking to find employment and homes in communities that have a multitude of transportation choices. A 2014 study by the Rockefeller Foundation and Transportation for America[4] reported that four in five millennials in ten major U.S. cities say they want to live in places where they have a variety of options to get to jobs, school or daily needs. Millennials are "driven by pragmatism"; with 46 percent saying a need to save money drives their choices. In addition, 44 percent of millennials value exercise and active lifestyles, 46 percent note convenience of transit and multi-modal options, and 35 percent say they want to live in a transit-friendly neighborhood.

According to the APTA study and the Rockefeller Foundation/Transportation for America, millennials would like to see the following from public transit in the next 10 years:

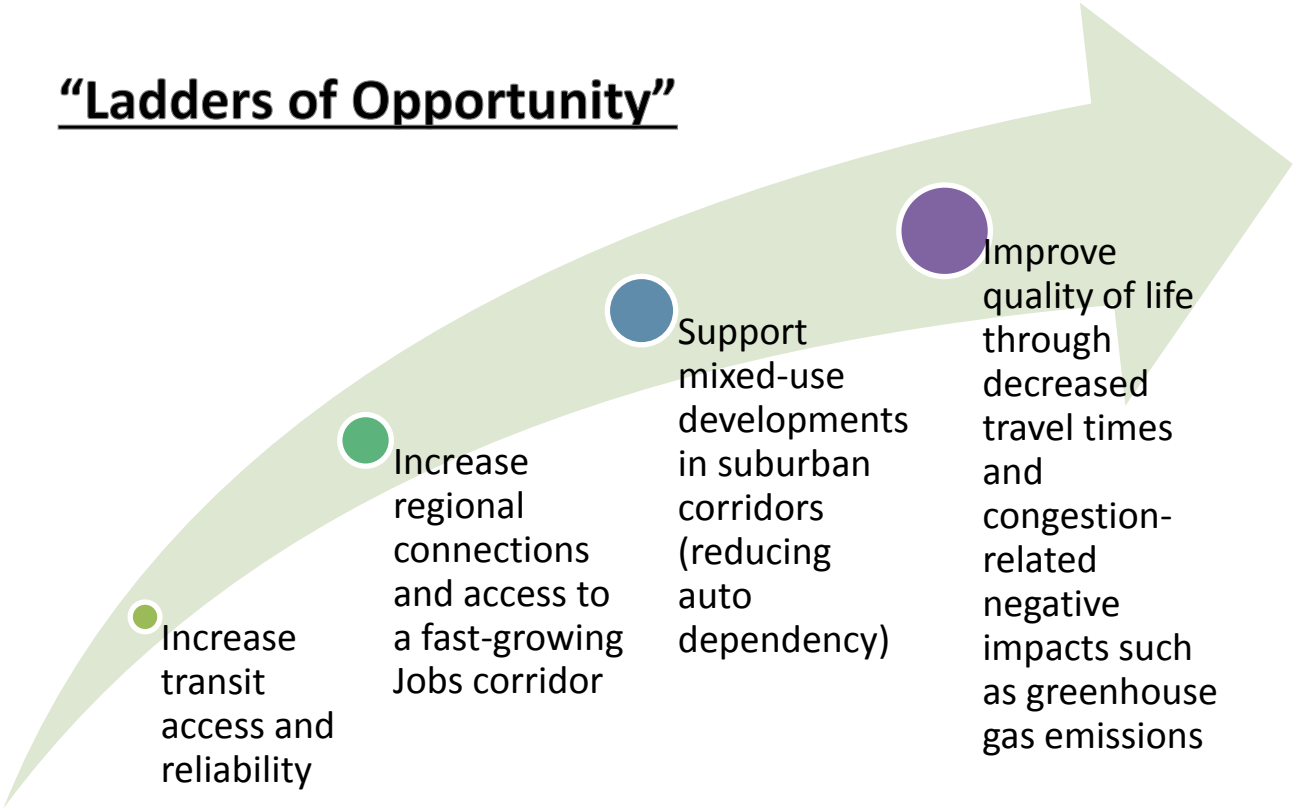
- Seventy percent who currently do not have regular access to a vehicle say they could not afford to live in an area without access to public transportation;
- Eighty-six percent say that it is important that their city offer a low-cost public transportation system with affordable fares, especially for those earning less than $30,000 a year;
- Sixty-four percent say that the expense of owning a car is a major reason they want be less reliant on one, including 77 percent of millennials who earn less than $30,000 a year;
- Ninety-one percent believe that investing in quality public transportation systems creates more jobs and improves the economy;
- Sixty-one percent want more reliable systems;
- Fifty-five percent want real-time updates;
- Fifty-five percent want Wi-Fi or 3G/4G wherever they go; and
- Forty-four percent want a more user-friendly and intuitive travel experience.

Figure 3-2 reflects transit dependent populations based on an index of populations below 18 years old and above 65 years old, populations below poverty level and households with one or less car.

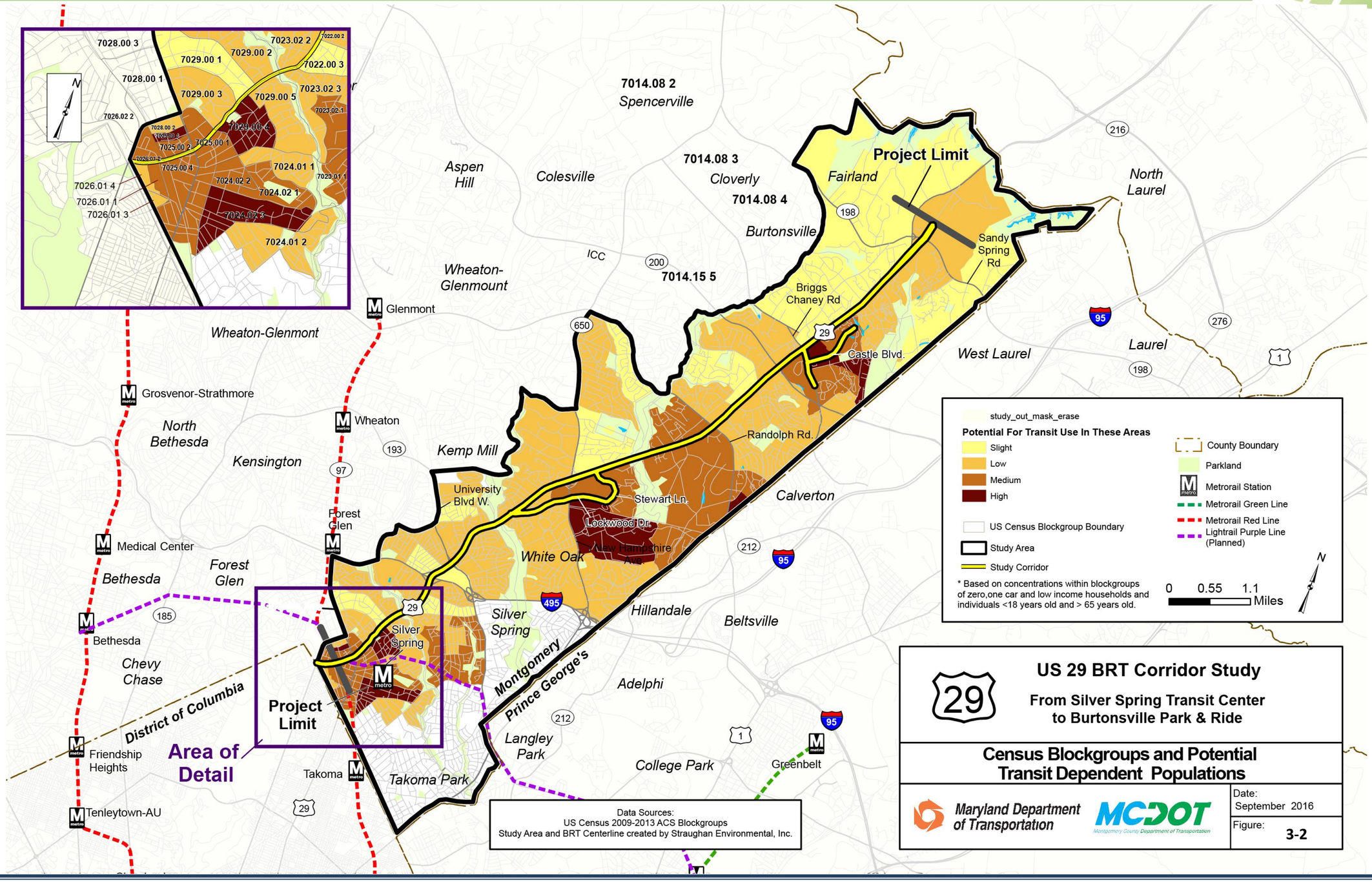
[3] American Public Transportation Association, *Millennials & Mobility: Understanding the Millennial Mindset*, 2015
[4] Rockefeller Foundation and Transportation for America, *Survey: To recruit and keep millennials, give them walkable places with good transit and other options*, 2014

By improving access to transit and addressing the existing and forecasted transit demand, particularly for the transit dependent, we can hope to provide "ladders of opportunity" for upward mobility and ultimately enhance the overall quality of life for Montgomery County residents (**Figure 3-1**). According to a Harvard Study, commute times were identified as the single strongest factor in the odds of escaping poverty.[5] In the immediate future, providing faster service with reduced travel times could provide transit dependent populations more flexibility and convenience in their daily lives. In the long term, these transit enhancements could provide the framework for upward mobility. In addition, BRT enhancements could provide immediate, positive benefits to the diverse populations living along the corridor.

Figure 3-1: "Ladders of Opportunity" – How Enhanced Transit Can Improve Quality of Life



[5] "Transportation Emerges as Crucial to Escaping Poverty." The New York Times, May 7, 2015.


7028.00 3
7029.00 1
7028.00 1
7029.00 3
7029.00 5
7029.00 2
7023.02 2
7022.00 2
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7023.02 3
7023.02 1
7029.00 4
7026.02 2
7028.00 2
7025.00 3
7025.00 2
7025.00 1
7026.01 2
7025.00 4
7024.01 1
7023.01 1
7024.02 2
7024.02 1
7026.01 4
7026.01 1
7026.01 3
7024.02 3
7024.01 2
N
Aspen Hill
Colesville
7014.08 2
Spencerville
7014.08 3
Cloverly
7014.08 4
Burtonsville
Fairland
Project Limit
North Laurel
216
198
Sandy Spring Rd
ICC
200
7014.15 5
Wheaton-Glenmont
Briggs Chaney Rd
650
29
Castle Blvd.
95
276
Laurel
West Laurel
1
Glenmont
Wheaton-Glenmont
Grosvenor-Strathmore
North Bethesda
Kensington
Wheaton
193
97
Kemp Mill
Randolph Rd.
University Blvd W.
Stewart Ln.
Lockwood Dr.
New Hampshire Ave
Calverton
Forest Glen
Medical Center
Bethesda
Forest Glen
White Oak
212
185
Silver Spring
Hillandale
Beltsville
Chevy Chase
District of Columbia
Montgomery
Prince George's
Adelphi
Project Limit
Area of Detail
Friendship Heights
Takoma
Takoma Park
Langley Park
College Park
Greenbelt
Tenleytown-AU
Data Sources:
US Census 2009-2013 ACS Blockgroups
Study Area and BRT Centerline created by Straughan Environmental, Inc.
study_out_mask_erase
Potential For Transit Use In These Areas
Slight
Low
Medium
High
US Census Blockgroup Boundary
Study Area
Study Corridor
County Boundary
Parkland
Metrorail Station
Metrorail Green Line
Metrorail Red Line
Lightrail Purple Line (Planned)
* Based on concentrations within blockgroups of zero,one car and low income households and individuals <18 years old and > 65 years old.
0 0.55 1.1 Miles
US 29 BRT Corridor Study
From Silver Spring Transit Center to Burtonsville Park & Ride
Census Blockgroups and Potential Transit Dependent Populations
Maryland Department of Transportation
MCDOT
Date: September 2016
Figure: 3-2

3.3.3 Limited Connectivity for Pedestrians and Bicyclists

Accommodations for walking and bicycling are essential components of planning, design, construction, operations, and maintenance activities of any transportation project, but they are especially important for a premium transit service. A preliminary analysis of pedestrian connections in the US 29 BRT Study Corridor reveal that sidewalks exist predominantly south of New Hampshire Avenue in the northbound direction from the Silver Spring Transit Center to Oak Leaf Drive and on all of Lockwood Drive and Stewart Lane. In the southbound direction, sidewalks are intermittent between MD 650 and Southwood Avenue, then continuous from Southwood Avenue to the Silver Spring Transit Center. The size and condition of these sidewalks must be reviewed further. These are important determining factors for the likelihood sidewalks would be used to access transit services. There are no sidewalks on US 29 between New Hampshire Avenue and MD 198, making pedestrian movements difficult and impacting their ability to safely walk to existing bus stops.

The 2005 Montgomery County's Countywide Bikeways Functional Master Plan (currently being updated) states that "current state and county policies require that all new roads and highways be designed to accommodate bicycles and that all road improvement projects be designed to incorporate bicycle elements where feasible." This is in acknowledgement of the health benefits of bicycling and its role as a viable mode of transportation.

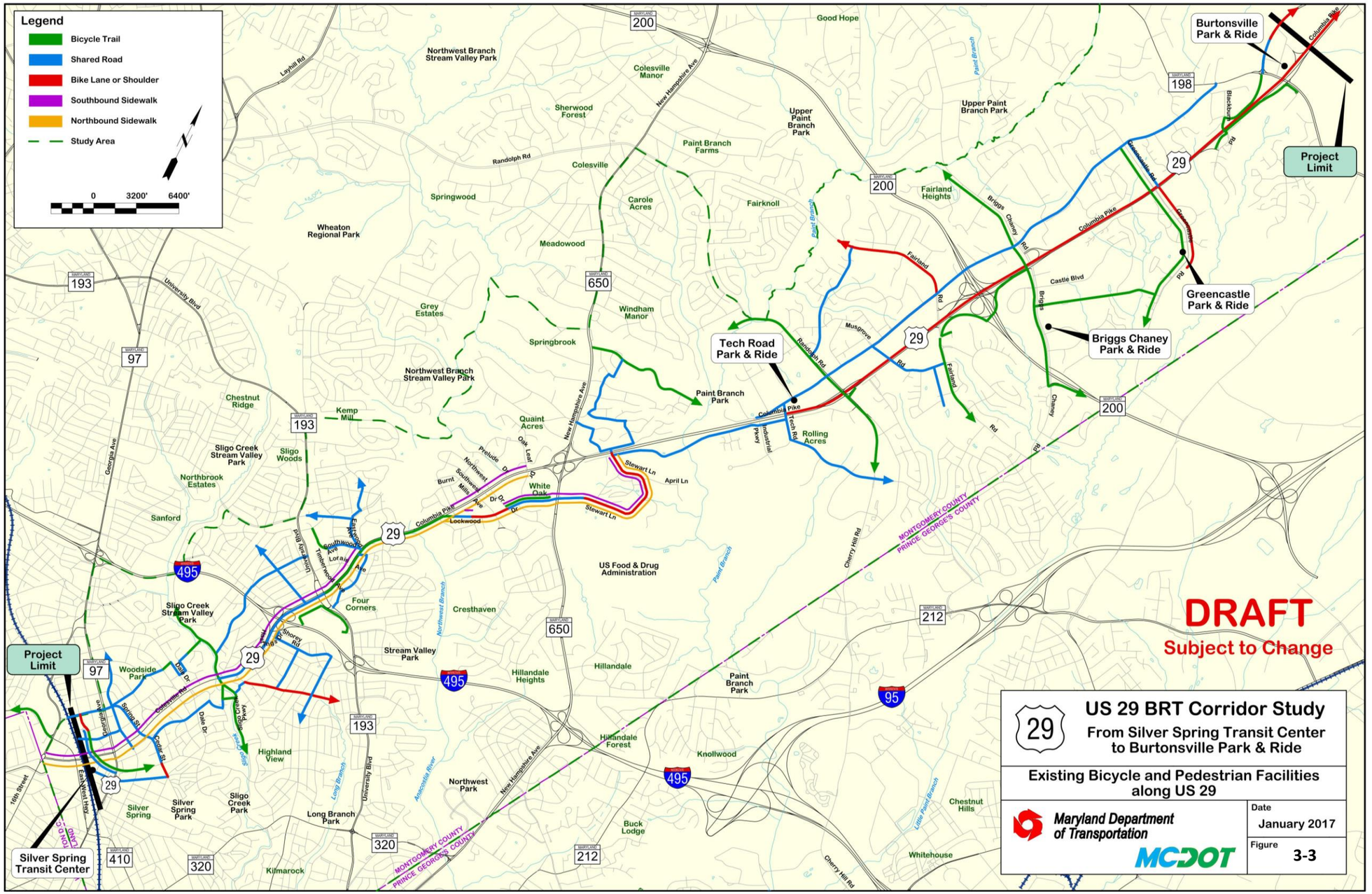
"Share the Road" signed bicycle routes exist throughout the corridor. There are signs along sections of US 29 indicating bicyclists may share the road with motorists and areas where bicyclists may use the shoulder. All other bicycle routes enter and exit the corridor at various points. Lockwood Drive and Stewart Lane have a mix of shared roadway, striped bike lanes, and shoulders provided for bicyclists. **Figure 3-3** shows the existing pedestrian and bicycle facilities along the corridor. Similar to sidewalks, bicycle routes must be reviewed to determine how they would relate to and support connectivity to proposed transit improvements.

Coordination with Capital Bikeshare programs could further incentivize travelers to utilize bicycles as a convenient, healthy, and sustainable transportation option. Capital Bikeshare has 350 stations throughout the DC metropolitan region, including 58 bikeshare stations in Montgomery County. Montgomery County currently offers low-income residents free bikeshare memberships, training, helmets, and route planning. Additional Bikeshare stations could be added at proposed BRT stations.

Further analysis of pedestrian and bicycle routes, in the context of the vehicular traffic movement, existing transit services, and proposed transit improvements would support the County's goal for multi-modal transportation in the US 29 Study Corridor. This comprehensive

approach will improve the Transit-Oriented Development (TOD) potential in the corridor and increase the focus on accessibility and safety for pedestrians and bicyclists. In addition, any proposed roadway improvements to SHA facilities would require a review and approval and/or design exception from SHA that the proposed improvements are consistent with the MDOT/SHA Bicycle Policy & Design Guidelines (2015).

Opportunities to enhance bicycle and pedestrian connections have been assessed as part of the preliminary conceptual alternatives development and evaluation process and will need to be carried forward as part of any subsequent related studies.



Source: Montgomery County Department of Transportation

3.3.4 Planned Growth and Development within the Study Area

Located in the most populous county in Maryland, the Study Area, along with the rest of the County, is expected to experience growth in population and employment. Growth forecasts for the Study Area are based on the latest land use forecasts in Cooperative Forecasting Round 8.3 of the MWCOG/TPB. **Table 3-4** summarizes population, households, and employment growth between the base year 2014 and the forecasted year 2040 for the US 29 BRT Corridor Planning Study Area.

Table 3-4: Population, Household, and Employment Growth, 2014 and 2040

	Population			Households			Employment		
	2014	2040	Percent Change	2014	2040	Percent Change	2014	2040	Percent Change
Study Area	137,500	155,500	13%	52,060	60,920	17%	67,125	119,650	78%

Source: MWCOG/TPB Round 8.3 Cooperative Forecasting

As population, households, and employment opportunities grow within the Study Area, the following increases between 2014 and 2040 are anticipated:

- Internal US 29 trips are expected to increase by 29 percent;
- Total vehicle miles travelled are anticipated to increase by 15 percent;
- Metrorail usage at Silver Spring and the adjacent Forest Glen and Wheaton Stations are forecasted to grow by 40 percent; and
- Metrobus Z-line ridership is expected to grow by 36 percent.

New development will drive growth in Montgomery County and the Study Area. **Table 3-5** provides a list of reasonably foreseeable development projects within the US 29 BRT vicinity include both pending and recently approved projects identified by the County's Development Activity Information Center (DAIC). The locations of these projects are illustrated in **Figure 3-4**, which shows that development activity is largely concentrated in the vicinity of Silver Spring. The County also anticipates a concentration of development, in White Oak as envisioned in the White Oak Science Gateway Master Plan. Additional development proposed for Fairland and Burtonsville results in growth throughout the US 29 corridor that would benefit from multi-modal transportation networks with high quality transit services. Montgomery County identifies the following planned transportation facilities in the vicinity of the US 29 BRT corridor

related to the BRT project (Source: MWCOG/TPB, the 2014 Constrained Long Range Plan, and the White Oak Science Gateway Master Plan):

- Extension of Old Columbia Pike to Lockwood Drive
- Connector roads between Plum Orchard Court, Whitethorn Court, and Cherry Hill Road
- Provision of local grid of streets and access roads in Burtonsville
- Purple Line Transitway
- Metrorail Silver Line
- Interchange at Musgrove Road/Fairland Road
- White Oak Science Gateway Master Plan Transportation Improvements (Not currently programmed):
    - BRT Network
    - Old Columbia Pike Bridge opened to vehicular traffic
    - Planned US 29 grade-separated interchanges at Tech Road/Industrial Road
    - New local roads proposed in the Life Sciences/FDA Village Center
    - Intersection geometric improvements

Current transportation infrastructure in the US 29 BRT Study Corridor between the Silver Spring Transit Center and Burtonsville Park and Ride is generally congested and may not be able to offer the capacity needed to support continued growth in eastern Montgomery County. Based on the White Oak Gateway Master Plan, “transportation problems, and attempts to solve or relieve traffic congestion, have characterized the eastern County for 30 years.” The US 29 corridor will need a substantial transit upgrade in order to handle future growth demand. Additional transit options along US 29 would support the planned TOD development and growth radiating outward from Silver Spring, thus capitalizing on public investments in transit by producing local and regional benefits. Direct benefits of this TOD could include increased ridership, revitalization of neighborhoods, financial gains for joint development opportunities, increases in the supply of affordable housing, and profits to those who own land and businesses near transit stops. Secondary benefits include congestion relief, land conservation, reduced outlays for roads, and improved safety for pedestrians and cyclists (United States Department of Transportation (US DOT, 2012))

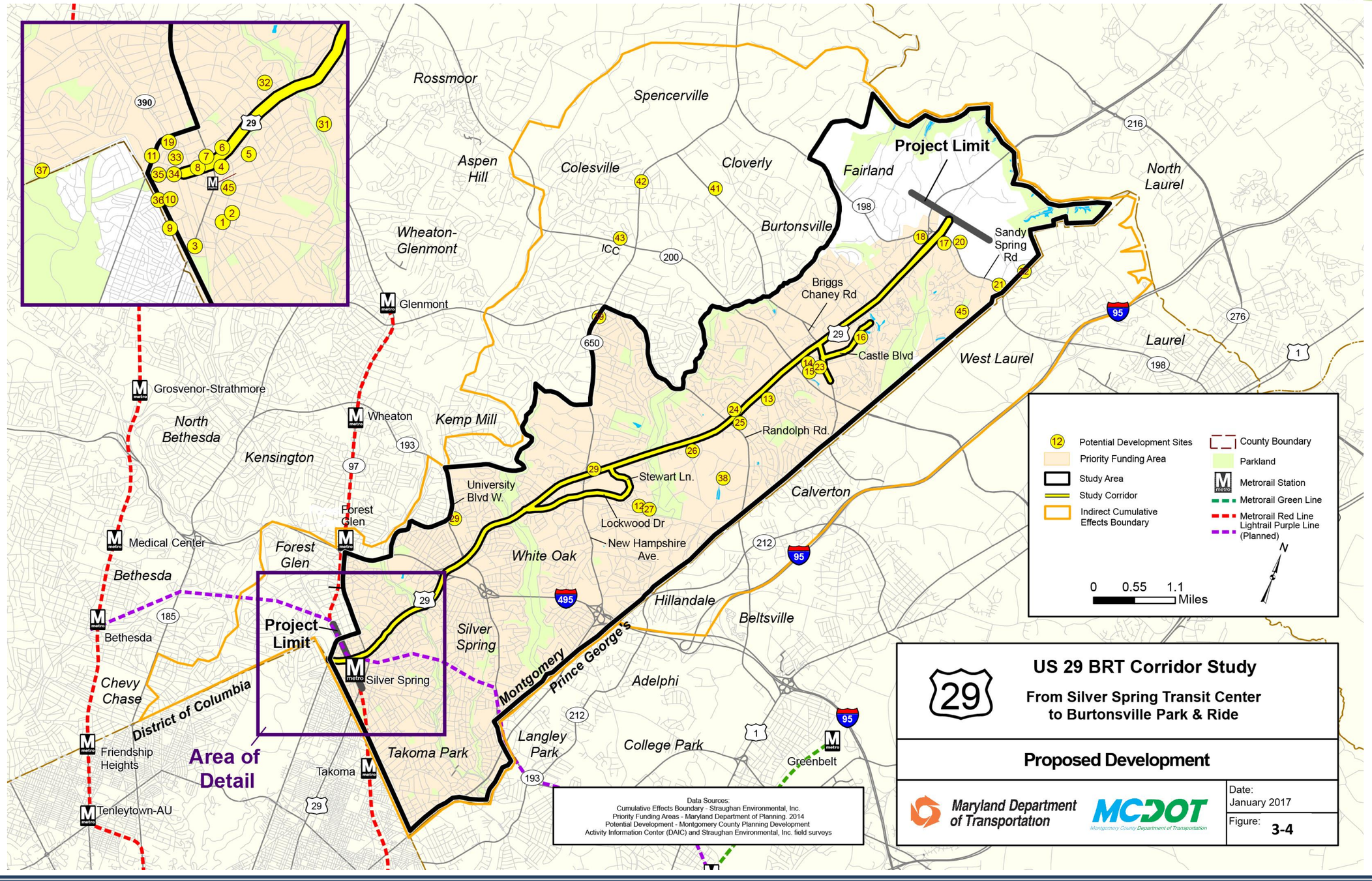

Rossmoor
Spencerville
Aspen Hill
Colesville
Cloverly
Fairland
Project Limit
North Laurel
Wheaton-Glenmont
ICC
Burtonsville
Sandy Spring Rd
Briggs Chaney Rd
Glenmont
Castle Blvd
West Laurel
Laurel
Grosvenor-Strathmore
North Bethesda
Wheaton
Kemp Mill
Kensington
Randolph Rd.
University Blvd W.
Stewart Ln.
Calverton
Forest Glen
Lockwood Dr
Medical Center
New Hampshire Ave.
White Oak
Bethesda
Hillandale
Beltsville
Project Limit
Silver Spring
Silver Spring
Montgomery
Prince George's
Adelphi
Chevy Chase
District of Columbia
Area of Detail
Takoma Park
Langley Park
College Park
Friendship Heights
Takoma
Greenbelt
Tenleytown-AU
Potential Development Sites
Priority Funding Area
Study Area
Study Corridor
Indirect Cumulative Effects Boundary
County Boundary
Parkland
Metrorail Station
Metrorail Green Line
Metrorail Red Line
Lightrail Purple Line (Planned)
N
0 0.55 1.1 Miles
Data Sources:
Cumulative Effects Boundary - Straughan Environmental, Inc.
Priority Funding Areas - Maryland Department of Planning. 2014
Potential Development - Montgomery County Planning Development Activity Information Center (DAIC) and Straughan Environmental, Inc. field surveys
US 29 BRT Corridor Study
From Silver Spring Transit Center to Burtonsville Park & Ride
Proposed Development
Maryland Department of Transportation
MCDOT
Date: January 2017
Figure: 3-4

Table 3-5 Reasonably Foreseeable Development Projects

Map ID	Development Name	Description	Size	Plan Number
1	Silver Spring Park	Condo, Hotel, Retail, Office	1.57 ac	82010012A
2	819 Silver Spring Avenue	Office, Residential	0.19 ac	820140090
3	8021 Georgia Avenue	Condo	1.34 ac	82006038D
4	City Place	Office, Retail	2.48 ac	81988046E
5	Chelsea Court	Residential, Single-Family	5.25 ac	82013004A
6	United Therapeutics	Office, R&D, Retail	2.2 ac	82007020B
7	8621 Georgia Avenue	Condo, Office, Retail	0.69 ac	82011006B
8	Silver Spring Center	Office	0.74 ac	81982069A
9	8001 Newell Street	Condo, Retail	1.22 ac	820140020
10	The Blairs Buildings F1/F2	Condo	3.79 ac	820140170
11	Falkland North	Commercial, Condo	3.5 ac	82012005A
12	White Oak Property (Science Gateway)	Single-Family Attached	29.34 ac	82005018C
13	Fairland Data Center	General - Solar Panels	35.5 ac	81991030A
14	Montgomery Auto Sales Park Lot 17	Automobile-Related	4.78 ac	820140130
15	Montgomery Auto Sales Park Lot 18	Automobile-Related	3.32 ac	820140140
16	Woodlake	Condo	32.7 ac	81971011B
17	Star Pointe Plaza	Retail, Office, Restaurant	1.53 ac	82010002A
18	Burtonsville McDonalds	Restaurant	2.4 ac	820150020
19	Fenwick Station	Single-Family	2.84 ac	82012008A
20	Korean Antioch Church	Religious Worship	8.85 ac	120120260
21	Snowden's New Birmingham Manor	Church, Single-Family Detached	4.55 ac	120130010
22	Boswell's Addition to Riding Stable Estates	Single-Family Detached	5.89 ac	12008008A
23	Montgomery Auto Sales Park Lot 14	Automobile, Industrial, Retail	8.1 ac	11985027A
24	Guru Nanak Foundation of America	Religious/Institutional	11.07 ac	120120160
25	Deer Park	Single-Family Detached	2.8 ac	120100020
26	White Oak Town Center (Science Gateway)	Retail, Condo	6.98 ac	120150100
27	White Oak Property (Science Gateway)	Single-Family Detached	29.34 ac	11991099A
28	Victory Crossing	Religious/Institutional	12.79 ac	120140210
29	Northwood Knolls	Single-Family Detached	0.77 ac	120140200
30	Mt. Jezreel Senior Housing	Religious/Institutional	9.73 ac	120150020
31	Gough Property	Single-Family Detached	0.71	120140010
32	Woodside Park	Single-Family Detached	1.48 ac	120070230
33	Elizabeth Square	Retail, Condo, Restaurant	3.12 ac	120150030
34	Metro Plaza - Silver Spring	Condo, Office, Retail	1.44 ac	12009038A
35	Falkland North	Retail, Condo	9.77 ac	12007056A
36	The Blairs Master Plan	Condo, Hotel, Office, Restaurant, Retail	30.37	120130220
37	Rock Creek Forest (Hickey & Offutt's Subdivision)	Single-Family Detached	1.56 ac	120070550
38	Washington Adventist Hospital	Hospital	48.86 ac	82008021C
39	Colesville Eckerd Drug Store #6328	Commercial, Office	2.04 ac	82002032B
40	PMG Silver Spring	Commercial	1.25 ac	120140100
41	Eco Estates	Single-Family Detached	12.83 ac	120080430
42	Shiloh Christian Fellowship Church	Single-Family Detached/Religious/Institutional	2.58 ac	120110230
43	Beall's Manor	Single-Family Detached	2 ac	120140030
44	No Gain	Single-Family Detached	0.85 ac	120130170
45	Fairland Park Community	Single-Family Detached/Attached	130.45 ac	12005020A /82005006C
46	Silver Spring Library (construction near complete)	Library	<1 ac	unknown

3.3.4.1 *Forecasted Future (2040) Traffic Conditions*

Under forecasted 2040 traffic conditions, the ADT ranges from a low of approximately 41,700 vehicles south of Fenton Street to a high of 88,100 vehicles north of Crestmoor Drive (see **Table 3-6**), an increase of four percent to 13 percent over existing 2015 volumes. This increase is representative of the anticipated growth in population, households, and economic development that will exacerbate congestion in the Study Area.

Table 3-6: Existing 2015 and Forecasted No-Build ADT

Roadway Sections (North to South)	2015 Existing ADT (vehicles) *Lowest – Highest*	2040 No-Build ADT (vehicles) *Lowest – Highest*
Sandy Spring Road (MD 198) to Cherry Hill Road/E. Randolph Road	70,900 – 73,700	73,900 – 82,900
Cherry Hill Road/E. Randolph Road to New Hampshire Road (MD 650)	59,800 – 71,600	67,700 – 79,300
New Hampshire Road (MD 650) to University Boulevard (MD 193)	65,500 – 79,400	72,600 – 88,100
University Boulevard (MD 193) to Capital Beltway (I-495)	74,000	81,900
Capital Beltway (I-495) to Georgia Avenue (MD 97)	39,600 - 65,200	41,700 – 72,400

Source: 2015 Existing Data from Vehicle counts. 2040 No-Build Data from TPB/MWCOG regional transportation model Version 2.3.57, with land use forecast Round 8.3

3.3.4.2 *Forecasted Future (2040) Intersection Level of Service*

Along US 29 alone, seven intersections are noted to operate at LOS F under the AM and/or PM peak 2040 No-Build conditions. Seven additional intersections not on US 29, but associated with the US 29 corridor side streets, are also noted to operate at LOS F under the AM and/or PM peak No-Build conditions. Also, eight intersections that were operating acceptably under Existing 2015 conditions are forecast to deteriorate to LOS E under 2040 No-Build conditions. The Future 2040 No-Build AM peak experiences five new intersections operating at LOS E or LOS F, while the 2040 No-Build PM peak experiences sixteen intersections operating at LOS E or F when compared to Existing 2015 conditions. **Table 3-7** provides details on the future 2040 intersections forecasted to operate at LOS E or LOS F. These poorly operating intersections affect the speed with which buses, and other vehicles, can travel through the corridor.

Under existing and projected 2040 No-Build traffic conditions, motor vehicle and bus performance, including speed, reliability, and passenger comfort, are expected to decline in conjunction with the deteriorating traffic conditions.

Table 3-7: Existing 2015 and Forecasted No-Build Intersection LOS

US 29 Mainline Intersections (*Associated Side-street Intersections*)	2015 AM		2040 AM		2015 PM		2040 PM	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
US 29 at Bonifant St	6.7	A	11.1	B	14.4	B	**111.0**	**F**
US 29 at Wayne Ave	24.2	C	38.8	D	32.9	C	64.1	E
Colesville Rd at Wayne Ave/2nd Ave	36.6	D	37.4	D	53.6	D	**96.9**	**F**
US 29 at Fenton St	15.0	B	28.5	C	26.8	C	60.7	E
US 29 at Spring St	26.0	C	40.9	D	44.2	D	**126.5**	**F**
US 29 at Dale Dr	23.9	C	40.0	D	70.4	E	**141.9**	**F**
US 29 at Sligo Creek Pkwy	30.5	C	40.8	D	44.0	D	**102.3**	**F**
US 29 at Franklin Ave	18.6	B	**96.0**	**F**	14.2	B	**88.2**	**F**
US 29 at MD 193 (South)	32.4	C	39.2	D	35.9	D	62.7	E
MD 650 at Lockwood Dr	51.7	D	47.8	D	**145.5**	**F**	**142.9**	**F**
US 29 at Stewart Ln	14.3	B	12.7	B	20.5	C	66.4	E
US 29 at Industrial Pkwy	15.6	B	24.0	C	48.1	D	**115.0**	**F**
US 29 at Tech Rd	**87.4**	**F**	**141.4**	**F**	42.8	D	**80.0**	**F**
US 29 at Randolph Rd	39.4	D	47.8	D	40.6	D	44.7	D
Randolph Rd at Old Columbia Pike	32.1	C	**81.1**	**F**	29.0	C	30.3	C
Fairland Rd at Old Columbia Pike	44.3	D	48.7	D	37.2	D	**111.7**	**F**
Briggs Chaney Rd at Castle Blvd	34.4	C	78.5	E	57.4	E	**111.6**	**F**
US 29 at Greencastle Rd	72.5	E	78.1	E	48.8	D	47.6	D
US 29 at MD 198	20.8	C	23.2	C	35.2	D	34.7	C
MD 198 at Old Columbia Pike	40.8	D	**105.9**	**F**	67.9	E	**102.8**	**F**
Old Columbia Pike at National Dr	4.3	A	**121.5**	**F**	11.7	B	63.3	E

Source: SHA, *US 29 BRT Draft Preliminary Purpose and Need (December 2015)* , 2040 No-Build Data from TPB/MWCOG regional transportation model Version 2.3.57, with land use forecast Round 8.3

4 Defining BRT Alternatives

The Study Team has identified three main components that comprise the alternatives studied: Running Ways, Service Plans, and Station Locations. This chapter gives a brief overview of what those different components are and how they work together to form an alternative.

4.1 BRT Components Summary

4.1.1 Bus Running Ways

Bus running ways are best described as the physical roadway elements that are built or modified to accommodate dedicated bus services separate from general purpose traffic. Running way types vary in the degree that they are separated from the general purpose traffic and use of TSP. The running ways considered for US 29 BRT are described below.

4.1.1.1 *Bus-on-Outside-Shoulder*

Under this option, BRT vehicles would operate in the partially dedicated right outside shoulder of the general traffic lanes. Use of this running way is sometimes limited to peak hour periods or congested conditions, and usually with operating constraints such as a maximum operating speed that is under the posted speed limit. Bus-on-outside-shoulder does encounter conflict points with access points, intersections, and interchange ramps that would require buses to yield. Today, buses are permitted to travel on the outside shoulders of US 29 north of Industrial Parkway during peak periods when general travel lanes are congested and moving slower than 35 mph.

4.1.1.1 *Median Shoulder BRT Lane*

The median shoulder BRT Lane bus running way would utilize the left inside shoulders and portions of the median to provide dedicated lanes for BRT and Commuter buses. Using the median running ways is less constrained than using other running way options studied. They are not limited by time of day (peak travel periods) or by maximum operating speeds under the posted speed limit (buses can drive at posted speeds), and have fewer intersections and conflict points with general purpose traffic.

4.1.1.2 *Managed Lanes*

BRT buses, local buses, high-occupancy vehicles (HOV) with two or more passengers, and vehicles turning right at intersections or access points share managed lanes. Managed lanes are typically repurposed from existing general travel lanes by adding travel restrictions to single occupant vehicles, thereby providing dedicated or partially dedicated lanes to transit and other

high-occupancy vehicles. These dedicated/partially dedicated running ways are often located on the outermost right curb lanes (although, other inside lanes could also be repurposed), and are not physically separated from the general purpose traffic lanes, allowing all vehicles make turns at intersections and access points.

4.1.1.3 *Business Access Transit (BAT) Lanes*

BRT buses, local buses, and vehicles turning right at intersections or access points share the BAT Lanes. Similar to managed lanes, BAT lanes are typically repurposed from existing general travel lanes by adding travel restrictions to vehicles. The partially dedicated BAT lanes are often located on the outermost right lanes and are not physically separated from the general purpose traffic lanes, allowing turning movements at intersections and access to local businesses and residences. BAT lanes are slightly different from the managed lanes in that non-bus HOVs are restricted from the BAT lanes and must remain in the general purpose traffic lanes.

4.1.1.4 *Mixed-use Lane*

Buses and general traffic vehicles are permitted to ride in mixed-use lanes. Potential intersection enhancements such as widening and auxiliary lane additions could provide buses the option of "jumping the queue" at these locations and improve service time and reliability. Otherwise, no modifications to the existing roadway would be pursued and BRT buses would run in regular general purpose traffic lanes.

4.1.2 Stations

4.1.2.1 *Station Locations*

The Montgomery County CTCFMP identified the following potential station locations for further study:

- Silver Spring Transit Center
- US 29 at Fenton Street / Spring Street
- US 29 at Franklin Avenue
- US 29 at MD 193
- US 29 at Burnt Mills Shopping Center
- Lockwood Drive at Oak Leaf Drive
- White Oak Transit Center
- US 29 at Tech Road Park and Ride
- US 29 at Fairland Road
- Briggs Chaney Road Park and Ride
- Burtonsville Park & Ride

Throughout the study process, the Study Team has made adjustments to station locations in coordination with WMATA, M-NCPPC, MCDOT and comments received from US 29 BRT CAC members. The following locations are proposed for the evaluation of conceptual alternatives:

- Silver Spring Transit Center – Curbside Station (Single Bus)
- US 29 at Fenton Street/Spring Street – Minimal Curbside & Curbside Station (Single Bus)
- US 29 at MD 193 – Split-Center Median Station for Alt. A
  US 29 at MD 193 – Curbside Station for Alt. B & Alt. B Modified
- US 29 at Burnt Mills Shopping Center – Curbside Station (Single Bus)
- Lockwood Drive at Oak Leaf Drive – Curbside Station
- White Oak Transit Center – Curbside Station
- Stewart Lane at April Lane – Curbside Station
- US 29 at Tech Road Park and Ride - Median Station for Alt. A & Alt. B Modified
  US 29 at Tech Road Park and Ride - Curbside Station for Alt. B
- US 29 at Briggs Chaney Road - Median Station for Alt. A
  No Station for Alt. B
- Castle Ridge Way at Castle Boulevard – Curbside Station (Single Bus)
- Castle Terrace at Castle Boulevard – Minimal Curbside & Curbside Station (Single Bus)
- Briggs Chaney Park and Ride - Curbside Station
- US 29 at MD 198 – Curbside Station

4.1.2.2 *Station Location Identification Process*

These locations and preliminary layouts have been modified in three steps:

- Step 1: Establish Service Area
- Step 2: Review Locations
- Step 3: Determine Station Layout

Step 1: Service Area – The Study Team utilizes the physical BRT Routes established as part of the service operations plan (discussed in detail later in this chapter), to establish the service area. The service area for this study includes US 29 from Silver Spring Transit Center to the Burtonsville Park and Ride. It also includes spurs along Lockwood Drive / Stewart Lane and Briggs Chaney Road / Castle Boulevard. Each of these areas is proposed to be served by the BRT system and require BRT stations.

Step 2: Review Locations – The Study Team reviewed numerous sources of data to determine preliminary locations where BRT stations would most likely find their highest ridership while also fitting efficiently into the surrounding community and transportation infrastructure. The data sources included master plans, existing station locations and ridership data, existing and

planned land uses, existing transportation facilities, existing natural and cultural resources, and specific feedback from CAC members and Study Team stakeholders. Access to and from employment and activity centers and residential developments, walkability and bikeability, proximity of parking, distance to bus transfers, potential impacts to surrounding features, and geographic spacing of BRT stations were considered in the investigation of potential station locations.

Step 3: Determine Station Layout / Site Footprint – Once a general location was determined to be suitable for a BRT Station, the Study Team investigated specific sites where the stations could be constructed. The team members looked at various station size and site footprint options to determine the preliminary design that was appropriate for the surrounding land uses and ridership activities. Then the station footprint was established to determine potential impacts to adjacent properties and existing features. Additional design details will need to be developed in a later phase. However, at this time, the preliminary station footprints provide a good estimation of where stations can be implemented in a way that maximizes efficiency for riders and BRT vehicles, and minimizes impacts to the surroundings.

4.1.2.3 *Preliminary Station sizes and layout configurations*

The preliminary station sizes and layout configurations currently under investigation are included below in **Table 4-1** below. Note that the dimensions and configurations are based on modeled 2040 ridership demand needs and are still a work in progress. The sizes and configurations are likely to differ by location, depending on specific site design requirements and needs. The final dimensions and diagrams will be revised during subsequent phases of design.

Assumptions used for US 29 stations were based on similar station typology and design recommendations developed and included in the Corridor Cities Transitway (CCT). The US 29 station estimate approach is also similar to MD 586 BRT Corridor Planning Study, which is another BRT project in Montgomery County.

The station diagrams that follow **(Figures 4-1, 4-2, 4-3, 4-4 and 4-5)** are rough illustrations of how the stations could potentially look if implemented for the modeled 2040 ridership demands. Note that the dimensions and layouts are still a work in progress and will differ from location to location depending on specific design requirements. The final dimensions and layouts will be completed during later phases of detailed design.

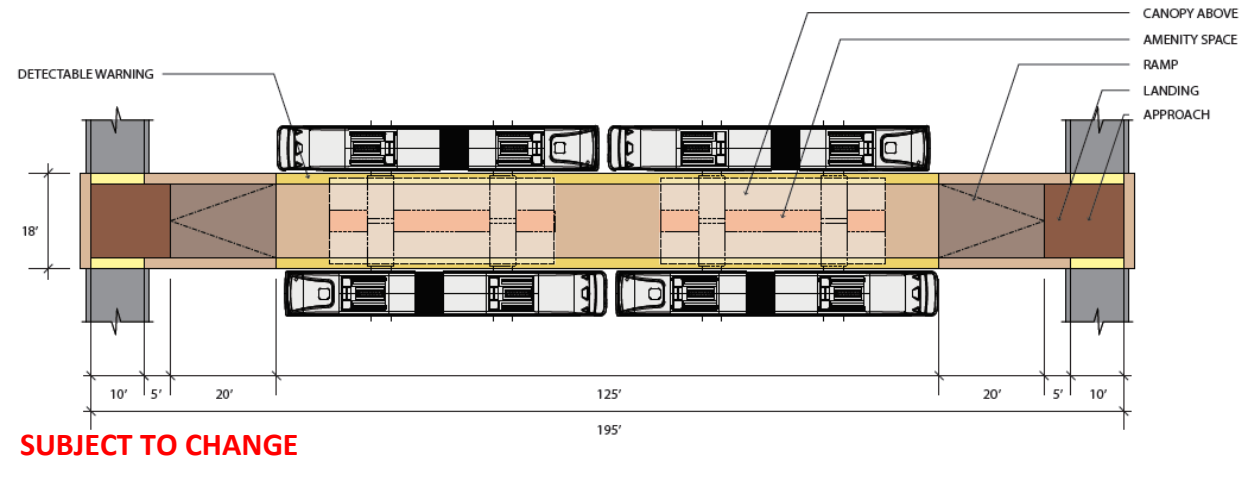
Note that for consistency purposes with other concurrent BRT studies, BRT platforms are defined as a singular raised area provided for level boarding and typically contains the shelter, canopy, benches, tactile warning strip, informational displays, etc. BRT stations are defined as the combination of BRT platforms, and any additional related access ways and ramps,

amenities, utility boxes, hardscape and landscape features for both directions of travel. In most cases BRT stations have both northbound and southbound curbside platforms and related features. The exception is with median stations, where only one platform would be required.

Table 4-1: Preliminary Station and Platform Sizes and Configurations

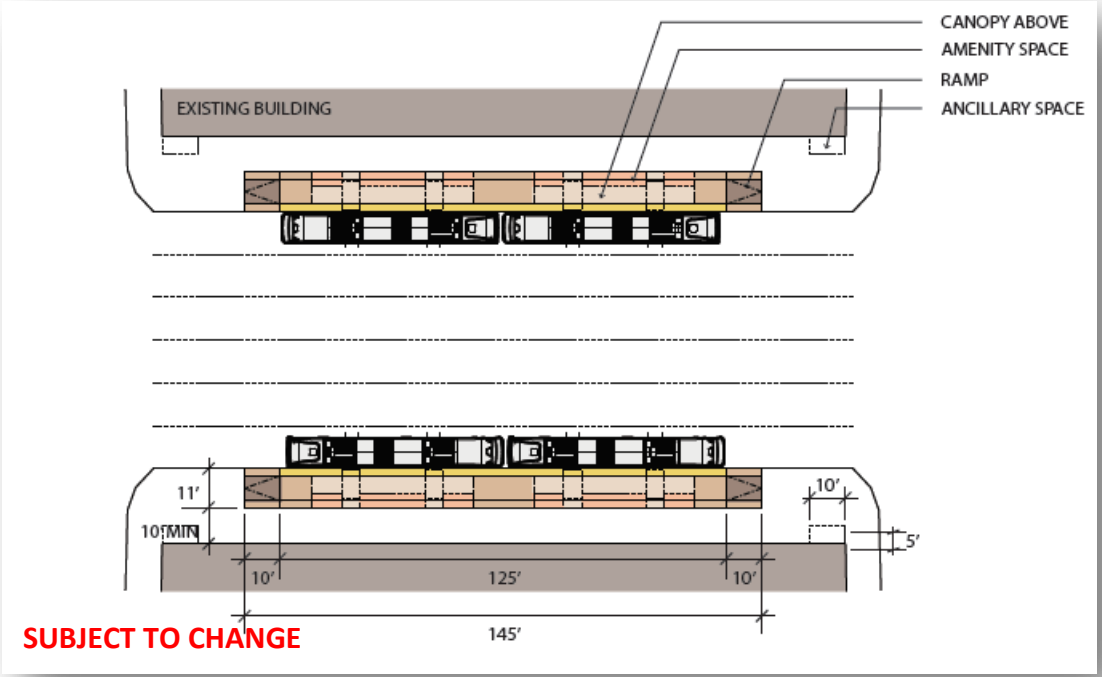
Station Type	BRT Bus Capacity	Location	Platform Dimensions (W x L)	Overall Station Dimensions (W x L)	Special Features
Median	2	Median	18 ft x 125 ft	18 ft x 195 ft	Two feet for a protective barrier between station and roadway
Curbside	2	Sidewalk	11 ft x 125 ft	11 ft x 145 ft	Additional sidewalk space must be reserved for mechanical/electrical boxes
Split Center Median	2	Median	13 ft x 125 ft	13 ft x 220 ft	Split Center Median - 5 foot landing area and a 25-foot ramp should be added beyond the crosswalk to access the platform. Large refuge area should be provided as overflow capacity.
Curbside (single bus)	1	Sidewalk	11 ft x 63 ft	11 ft x 83 ft	Additional sidewalk space must be reserved for mechanical/electrical boxes
Minimal Curbside (single bus)	1	Sidewalk	9 ft x 18 ft	11 ft x 30 ft	Width can vary depending on location to minimize impacts

Figure 4-1: Median Station & Platform



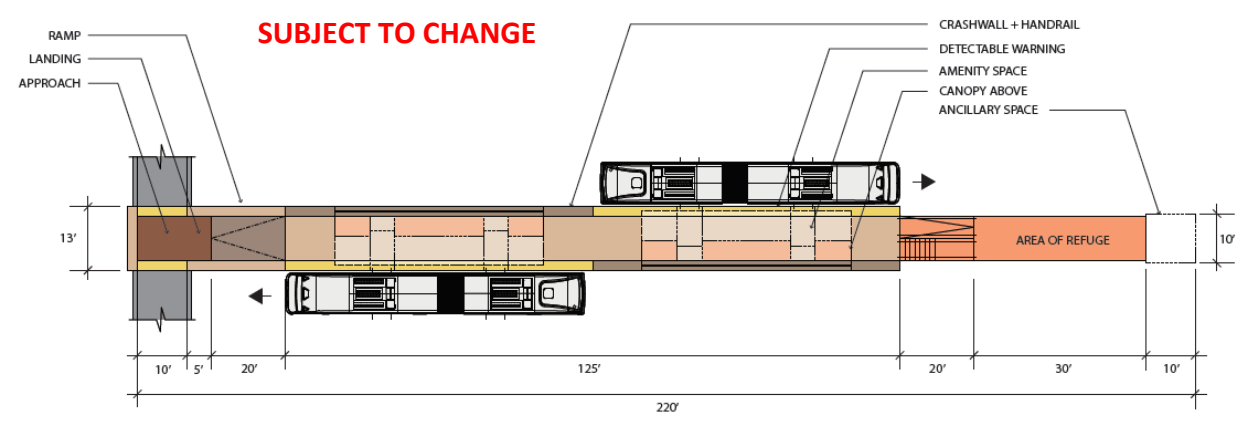
Not to Scale

Figure 4-2: Curbside Station & Platform



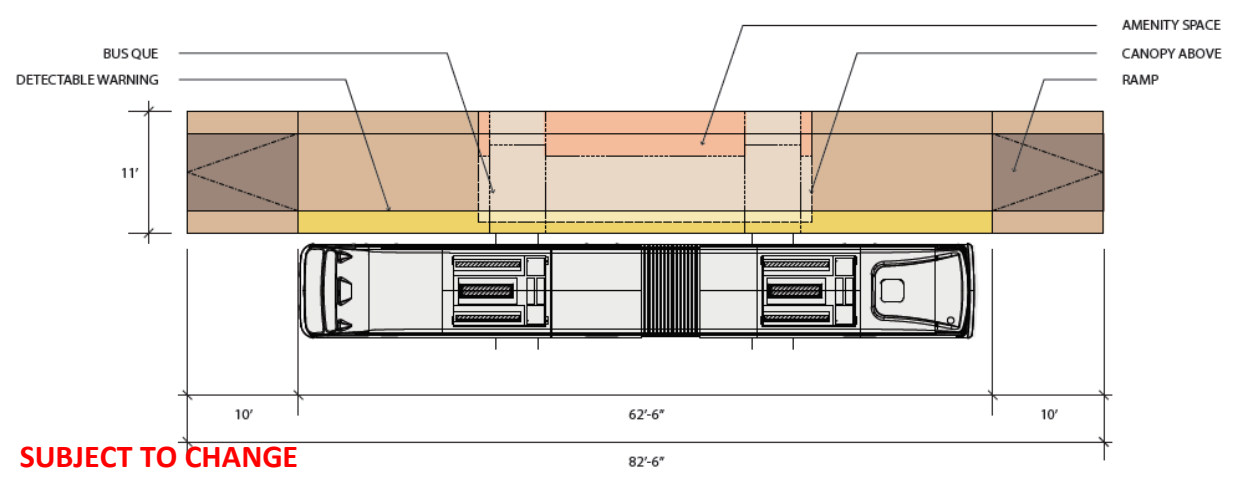
Not to Scale

Figure 4-3: Split-Center Median Station & Platform



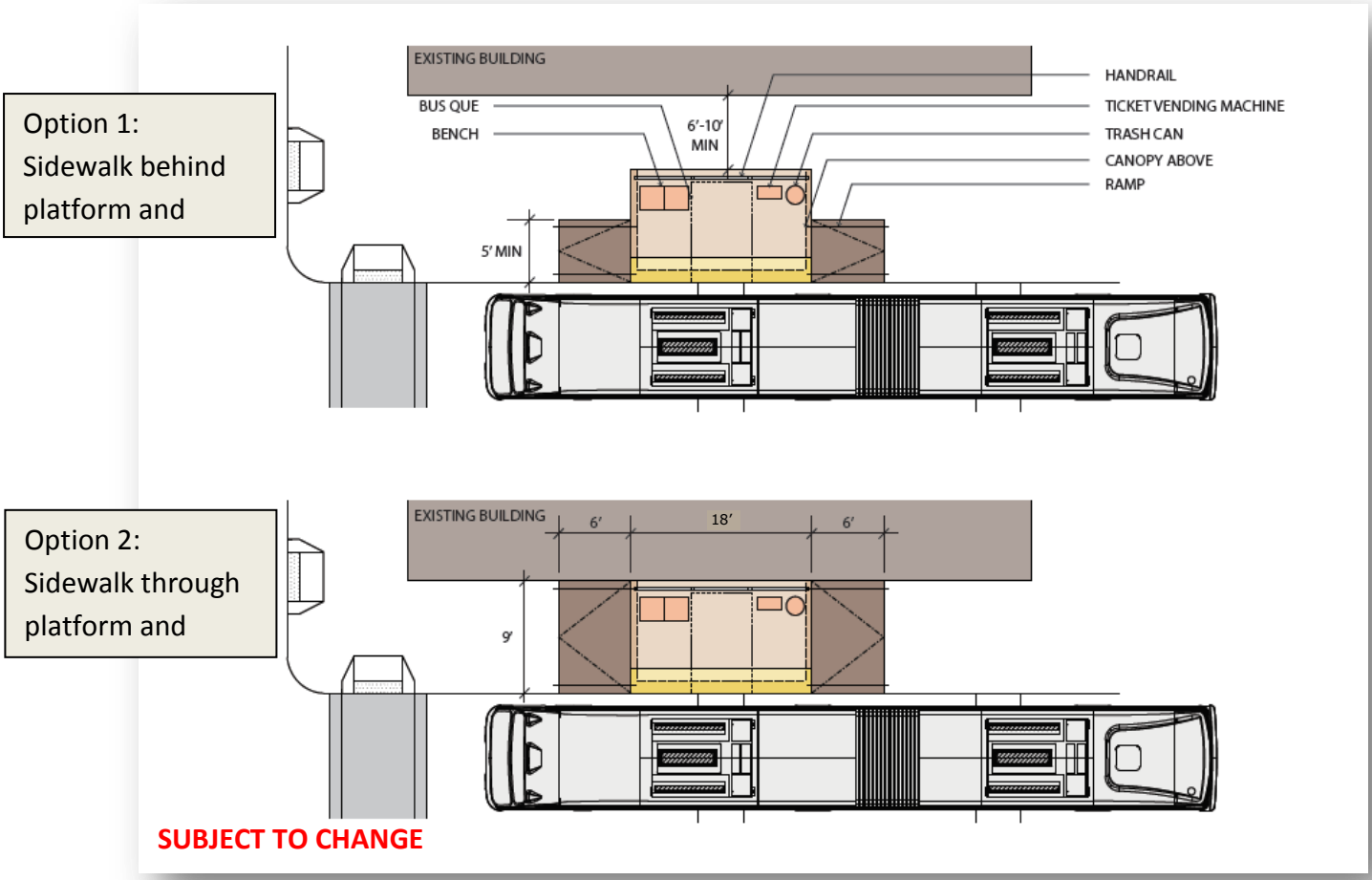
Not to Scale

Figure 4-4: Curbside Station & Platform (Single Bus)



Not to Scale

Figure 4-5: Minimal Curbside Station & Platform (Single Bus) – Two Options Shown



Not to Scale

4.1.2.4 *Station Features (subject to change)*

Stations are likely to feature the following ADA-compliant amenities and design elements. The final amenities will be determined during detailed design phases:

- Canopy and wind-screen shelter from weather elements;
- Off-board fare collection and ticket vending machine;
- Pedestrian, bicycle, and ADA access;
- Bicycle racks and lockers, bicycle share-program facilities;
- Safety call boxes, surveillance cameras;
- Raised platform for level boarding (approximately 14-inch curb height);
- Real-time transit information screens; and
- Lighting, benches, trash receptacles, and other hardscape and street furniture features.

Additionally, the station design and features will support and enhance the following surrounding community features:

- Existing and future land uses & development opportunities
- Pedestrian and bicycle network
- Local transit connections
- Vehicular patterns & physical barriers
- Landmarks
- Connections
- Local bus transfers

4.1.3 Service Operations Plan

A service operation plan was developed for use in preliminary analysis. Assumptions made for this preliminary analysis are provided below. However, the final service operations plan will likely change and will be appropriately evaluated as the study progresses through later design phases.

4.1.3.1 *Preliminary Analysis Assumptions*

BRT will run on US 29 in both directions. For the purposes of this analysis, BRT service is assumed to operate between 5:00 a.m. and midnight. Service patterns, or the BRT physical routes, will differ during peak and off-peak travel periods. Two service patterns are assumed for the peak period and one service pattern for the off-peak period, and are described in more detail in the section below. Maximum headways, or the time span between consecutive BRT buses (when one BRT bus arrives and the next BRT bus arrives), are maintained at 12 minutes for peak periods and ten minutes for off-peak periods. Because there are two patterns running simultaneously during the peak periods, the functional peak headways will be six minutes apart.

4.1.3.2 *US 29 BRT Pattern One*

Peak Period

In the peak period, Pattern One runs between Burtonsville Park and Ride and Silver Spring Transit Center via US 29 with 12-minute headways. It overlaps Pattern Two in some sections of US 29, reducing the functional headway to six minutes in the common sections. **Figure 4-6** provides an overview of the route and stations Pattern One serves during the peak period. Note that the exact location of stations varies for each alternative and are subject to change as each alternative is further developed. Additional details on station location are provided in Section 4.1.2.

Off-Peak Period

In the off-peak period, Pattern One runs between Burtonsville Park and Ride and Silver Spring Transit Center via Stewart Lane and Lockwood Drive, maintaining ten-minute headways. **Figure**

4-6 provides an overview of the route and stations Pattern One serves during the off-peak period.

4.1.3.3 *US 29 BRT Pattern Two*

In peak periods, Pattern Two runs between Briggs Chaney Park and Ride and Silver Spring Transit Center via Castle Boulevard, US 29, and Stewart Lane / Lockwood Drive. This pattern maintains 12-minute headways. In common sections where it overlaps with Pattern One, the effective headway is six minutes. Pattern Two is assumed to not operate in off-peak hours. **Figure 4-6** provides more detail on the route and stations Pattern Two services during the peak period.

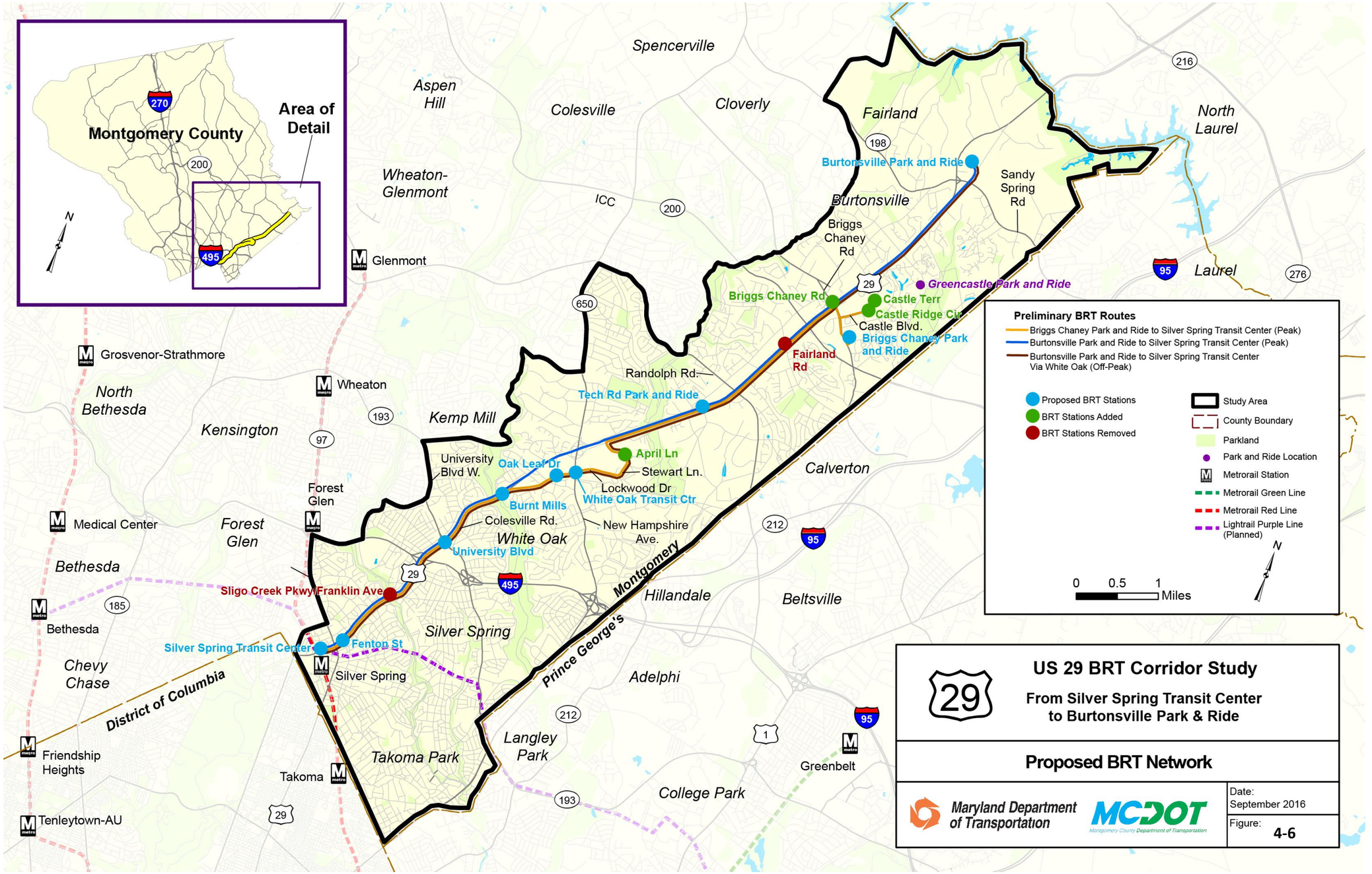
4.1.3.4 *Background Bus Network Changes*

The background bus network included in ridership and traffic analyses is the 2014 CLRP network. Changes are proposed for some routes/lines, but for those that are unchanged, headways and speeds are based on the CLRP network. Routing changes (route extensions to cover removal of express service) occur on the Metrobus Z6 and Z8 lines but there are no modifications to the headways for these two services. These services serve different rider markets than the BRT would.

In addition, the background bus network model assumes the following:

- Remove WMATA Z11 service from the network;
- Extend Z8 peak period service to Greencastle Park and Ride to cover Z11 service area for the No-Build peak period;
- Eliminate Z9/Z29 service from network;
- Extend Z6 peak period service to Burtonsville Park and Ride to cover the Z9/Z29 service area for the No-Build peak period;
- Create new circulator/feeder service between South Laurel Park and Ride and Burtonsville Park and Ride to cover the peak period trips eliminated with the removal of Z9/Z29;
- Finish Ride On 21 and 22 routes at the White Oak Transit Center[6]; and
- Extend K9 service from current FDA campus terminal up to the proposed White Oak Transit.

[6] Based upon public, feedback the Study Team has agreed to return Ride On Routes 21 and 22 to the background bus network as part of future refinement studies.



US 29 BRT Corridor Study

From Silver Spring Transit Center to Burtonsville Park & Ride

Proposed BRT Network

Maryland Department of Transportation MCDOT Montgomery County Department of Transportation

Date: September 2016

Figure: **4-6**

4.2 Preliminary Conceptual Alternatives

Eight preliminary conceptual alternatives were considered and qualitatively examined at a high level during the initial concept development phase. The preliminary conceptual alternatives included the following:

- Alternative 1 No-Build
- Alternative 2 TSM (Intersection Transit Signal Priority and Queue Jump Lane Widening)
- Alternative 3 Median BRT Lanes (Median and Left Turn Lane Repurposing)
- Alternative 4 Curb Business Access Transit (BAT) Lanes (Reversible Lane Repurposing and Widening)
- Alternative 5 Median BRT Lanes (Median Repurposing and Widening)
- Alternative 6 Curb Business Access Transit (BAT) Lanes (Curb Lane Repurposing)
- Alternative 7 Additional BRT Lanes (Widening)
- Alternative 8 Additional Curb BAT Lanes (Widening)

4.2.1 Preliminary Conceptual Alternatives Eliminated from Consideration

In early spring 2016, the Montgomery County Executive announced that the alternative implemented in the US 29 corridor had to be built within the existing right-of-way to avoid significant property impacts and should be implemented in fewer than four years to provide a rapid improvement to transit service in this critical commuter corridor. The announcement came after the initial public reaction, as expressed through the CAC, opposed any alternatives that would require major right-of-way acquisition or could create significant property impacts. Quick and reliable implementation was another major screening factor. Alternatives that required lengthy planning, design, and implementation process involving complicated property acquisition, environmental permitting, and construction efforts were dropped from consideration. The following alternatives were eliminated:

- Alternative 3 Median BRT Lanes (Median and Left Turn Lane Repurposing) – Eliminated due to impacts and construction schedule
- Alternative 4 Curb Business Access Transit (BAT) Lanes (Reversible Lane Repurposing and Widening) – Eliminated due to impacts
- Alternative 5 Median BRT Lanes (Median Repurposing and Widening) – Eliminated due to impacts
- Alternative 7 Additional BRT Lanes (Widening) – Eliminated due to impacts and schedule
- Alternative 8 Additional Curb BAT Lanes (Widening) – Eliminated due to impacts and schedule

4.3 Conceptual Build Alternatives

The County Executive proposed a new alternative, referred to as Alternative B in this report. This proposal had many of the characteristics of a Transportation System Management (TSM) alternative, including TSP and other transit and pedestrian friendly intersection operations modifications like extended pedestrian crossing times. The County Executive's proposal also incorporated some features of the original Conceptual Alternative 6, including lane repurposing and the use of shoulders by BRT buses. Two new conceptual alternatives – Alternative A (previously called preliminary conceptual alternative 6) and Alternative B (a modified version of preliminary conceptual alternative 6) – were developed by the Study Team for analysis to a higher level of detail and evaluation against the quantitative selection criteria. As the evaluation was underway the Study Team determined that a third alternative, one that is a hybrid of Alternative A and Alternative B should also be analyzed. Hence the Study Team developed Alternative B Modified. These three alternatives and the No-Build Alternative are the subjects of this Corridor Study Report. Alternative A, Alternative B, and Alternative B Modified are described in detail below. The screening process and the analysis results are described in Chapter 6.

4.3.1 Descriptions of the Proposed Conceptual Build Alternative Running Way Elements

The following sections provide descriptions of the No-Build Alternative and the three retained conceptual build alternatives, A, B, and B Modified.

4.3.1.1 *Description of the No-Build Running Way Alternative*

The No-Build Alternative includes planned and programmed transit and roadway improvements as listed in the 2014 CLRP. The Study Team uses this alternative to evaluate 2040 future conditions without BRT, and compare them to 2040 conditions with each of the two conceptual BRT alternatives.

4.3.1.2 *Description of Alternative A Running Way*

The main elements of Alternative A running way would include peak period median shoulder BRT lanes in the north and peak period curbside BAT Lanes in the south. Note that for all alternatives, peak periods are assumed to be from 6 a.m. to 9 a.m. and from 3 p.m. to 7 p.m. The BAT lanes would be created by repurposing the peak direction curb lane to accommodate BRT buses, local buses, and right turning traffic. Note that the peak period movement is southbound in the morning and northbound in the afternoon. All stations would be curbside stations unless noted. For description purposes, the alternatives are divided into geographical sections based on the specific running way improvements proposed in each section (see **Figures 4-7a, 4-7b, 4-7c, 4-7)**.

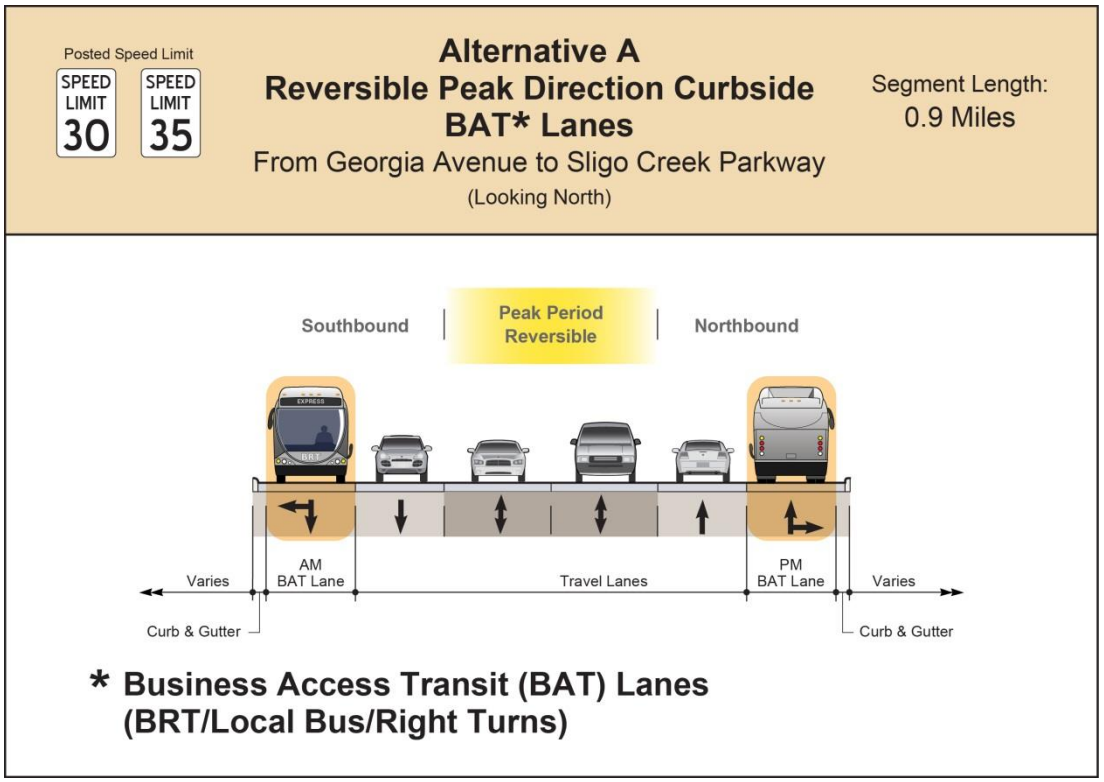
Section One: Silver Spring Transit Center to MD 97 / Fenton Street

- Buses would run in mixed traffic in southbound direction from Fenton Street to just south of MD 97 where buses will transition from the curb lane to the left lane to use the existing bus only lane to turn left into the Silver Spring Transit Center.
- Buses would run in mixed traffic in northbound direction from Silver Spring Transit Center to MD 97.
- A transition zone for northbound BAT lane during p.m. peak period between MD 97 and Fenton Street would be provided.
- During off-peak times, northbound buses would run in mixed traffic from Silver Spring Transit Center to Fenton Street.
- Existing overhead variable lanes signs (OVLS) would be modified or new OVLS would be provided to communicate when BAT lanes are active / inactive during peak and off-peak periods.
- Additional BAT lane signage and/or lane markings would be provided as needed.
- Existing left turn lanes and movements would be maintained for general traffic.

Section Two: MD 97 to Sligo Creek Parkway

- BAT lane in the peak direction during the peak period would be provided through repurposing of the peak direction curb lanes.
- Operation of existing reversible auto lanes would be maintained during peak periods.
- Off-peak direction buses would operate in mixed traffic during the peak period and off-peak period.
- Existing OVLS would be modified and/or new OVLS installed along with other signage / lane markings as needed.
- Left turn lanes and movements for general traffic would be maintained.

Figure 4-7a: Alternative A Reversible Peak Direction Curbside BAT Lanes (Section 2)



Section Three: Sligo Creek Parkway to Hasting Drive / Granville Drive

- BAT lanes would be provided in the peak direction through repurposing of the peak direction curb lanes.
- Off-peak direction buses would operate in mixed traffic.
- New OVLS and other signage / lane markings would be provided as needed.

Section Four: Hastings Drive / Granville Drive to Timberwood Avenue

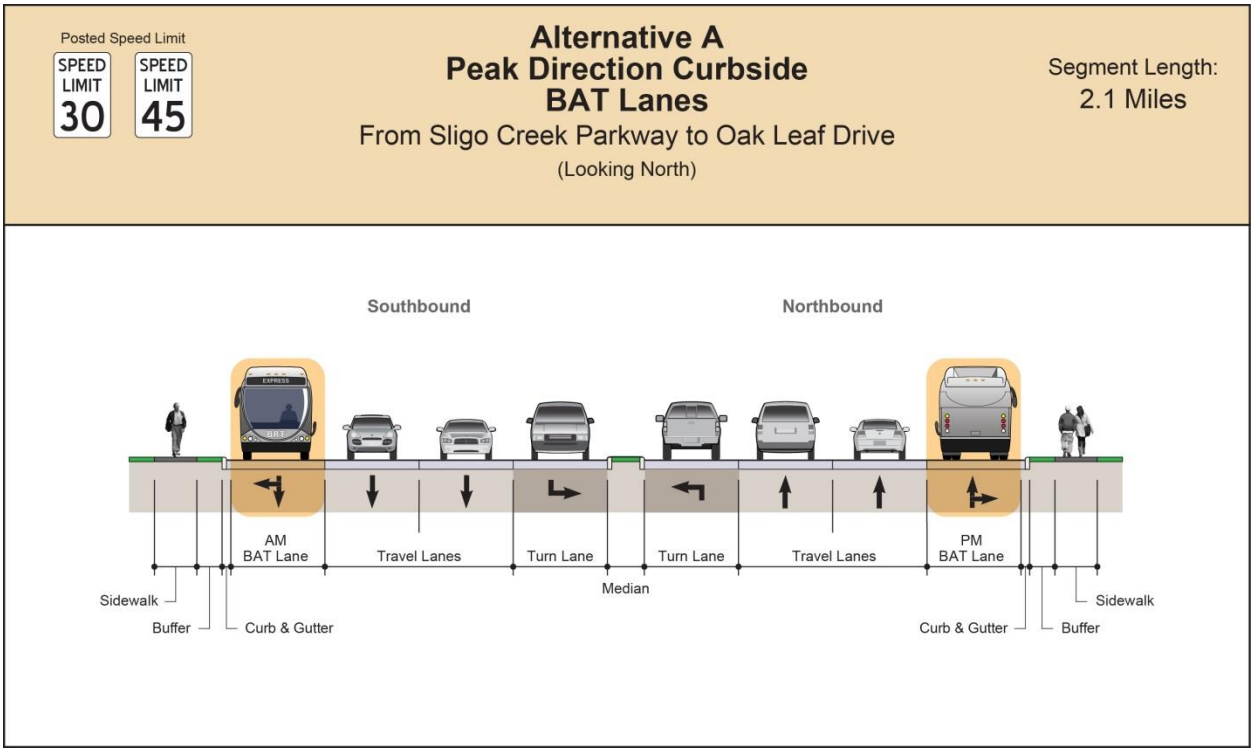
- All lanes and vehicles would operate as mixed traffic at all times.
- BRT buses would transition from the curb lanes to the left lanes to access the proposed median station between the eastbound and westbound legs of MD 193.

Section Five: Timberwood Avenue to Prelude Drive / Oak Leaf Drive

- BAT lanes would be provided in the peak direction through repurposing of the peak direction curb lanes.

- Off-peak direction buses would operate in mixed traffic.
- New OVLS and other signage / lane markings would be provided as needed.

Figure 4-7b: Alternative A Peak Direction Curbside BAT Lanes (Sections 4 and 5)



Section Six: Prelude Drive / Oak Leaf Drive to Stewart Lane

- All lanes and vehicles would operate as mixed traffic at all times.
- Northbound BRT buses would transition from the curb lanes to the left lanes to access the proposed median shoulder BRT lanes at Stewart Lane.
- Southbound BRT buses would transition from median shoulder BRT lanes to curb lanes

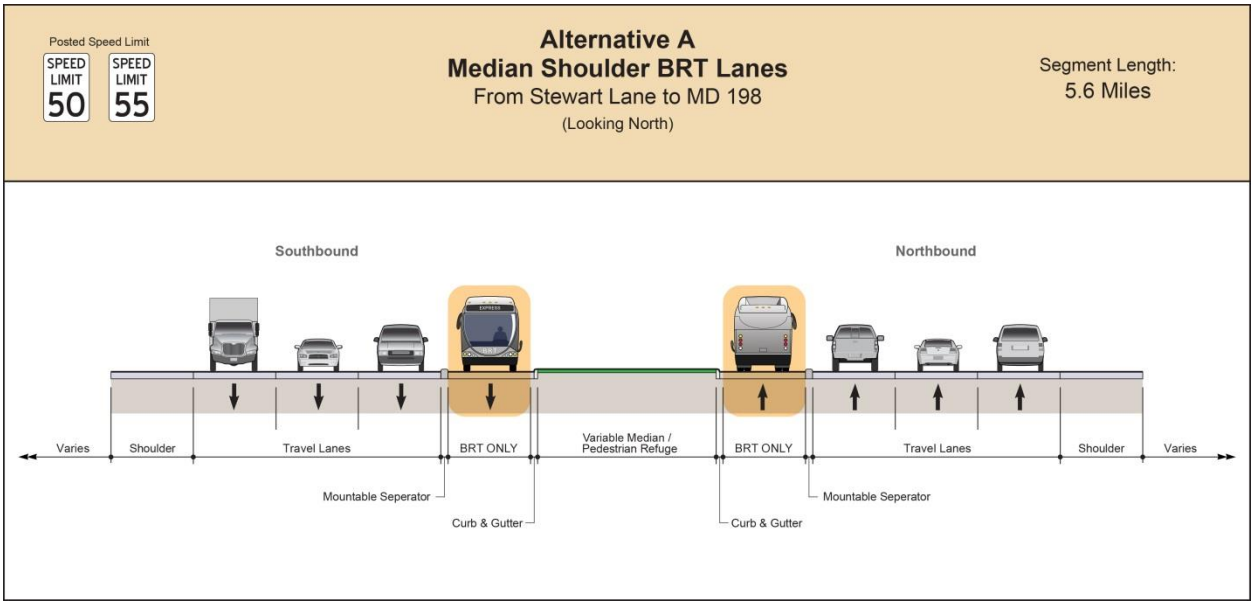
Section Seven: Lockwood Drive / Stewart Lane

- All lanes and vehicles would operate as mixed traffic at all times.
- Dedicated bicycle lanes would be provided within existing pavement.
- Continuous sidewalk connections would be provided as needed.

Section Eight: Stewart Lane to MD 198 and Burtonsville Park and Ride

- New median shoulder BRT lanes would be constructed where needed and/or existing median shoulder would be widened as needed to accommodate BRT buses operating at posted highway speeds.
- Existing signalized intersections would be reconstructed to accommodate median shoulder BRT lanes while maintaining existing turn and through lane movements and configurations.
- Only BRT buses would have access to run in median shoulder BRT lane.
- BRT buses would run in mixed traffic between MD 198 to Burtonsville Park and Ride
- Signage and lane markings would be provided as needed.

Figure 4-7c: Alternative A Median Shoulder BRT Lanes (Section 8)



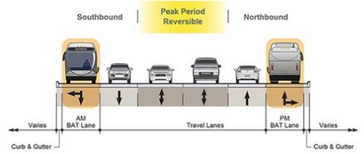
Section Nine: Briggs Chaney Road / Castle Boulevard

- All lanes and vehicles would operate as mixed traffic at all times.

Alternative A
Reversible Peak Direction Curbside BAT* Lanes
From Georgia Avenue to Sligo Creek Parkway
(Looking North)

Posted Speed Limit: 30 / 35

Segment Length: 0.9 Miles

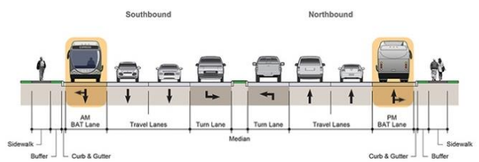


* Business Access Transit (BAT) Lanes (BRT/Local Bus/Right Turns)

Alternative A
Peak Direction Curbside BAT Lanes
From Sligo Creek Parkway to Oak Leaf Drive
(Looking North)

Posted Speed Limit: 30 / 45

Segment Length: 2.1 Miles



Alternative A
Mixed Traffic

Posted Speed Limit: 30 / 45

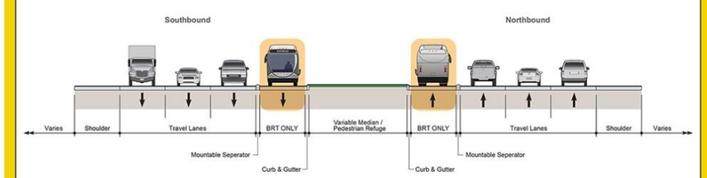
Segment Length: Varies

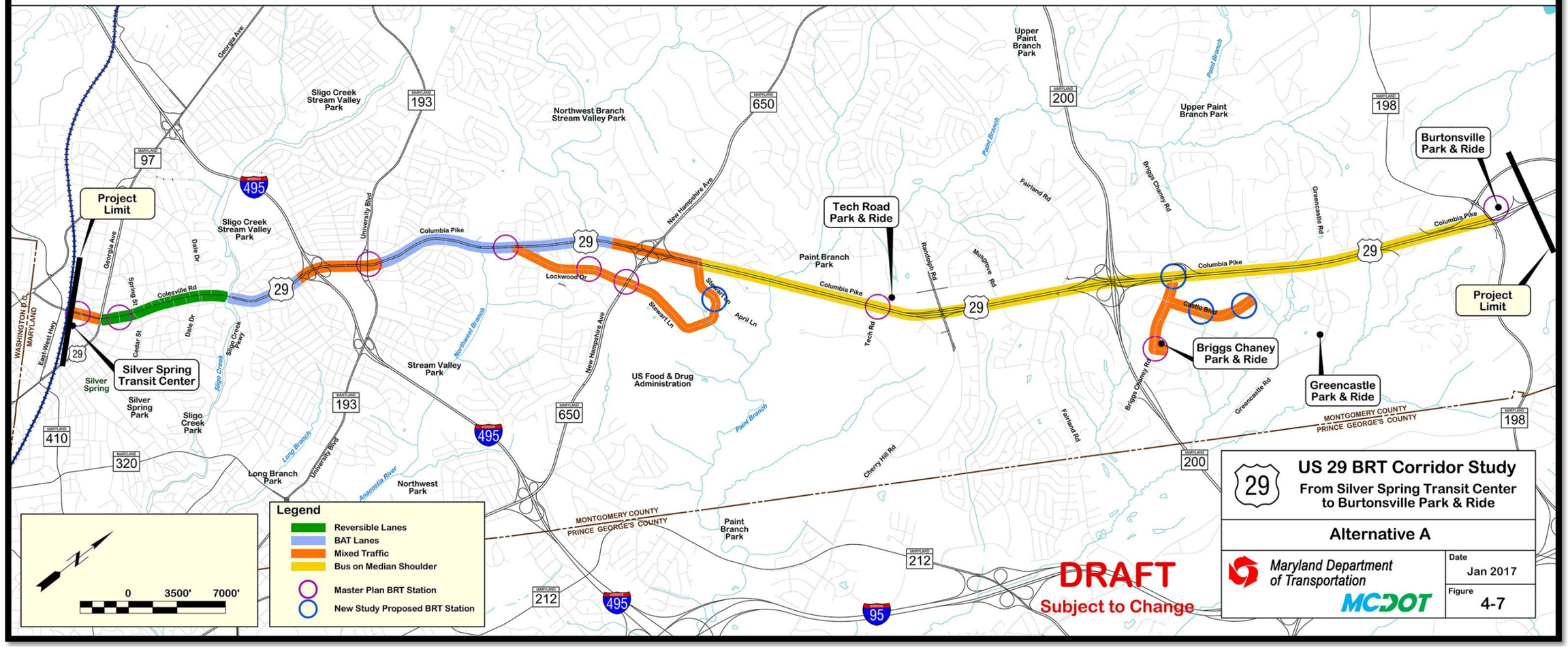
BRT IN MIXED TRAFFIC.
TYPICAL SECTIONS MATCH EXISTING CONDITIONS.

Alternative A
Median Shoulder BRT Lanes
From Stewart Lane to MD 198
(Looking North)

Posted Speed Limit: 50 / 55

Segment Length: 5.6 Miles





4.3.1.3 *Description of Alternative B Running Way*

Alternative B would feature managed lanes (HOV2+/BAT Lanes, also known as managed lanes) in the south and buses would operate on outside shoulders in the north. For description purposes, the alternatives are divided into geographical sections based on the specific running way improvements proposed in each section (see **Figures 4-8a, 4-8b, 4-8c, 4-8)**:

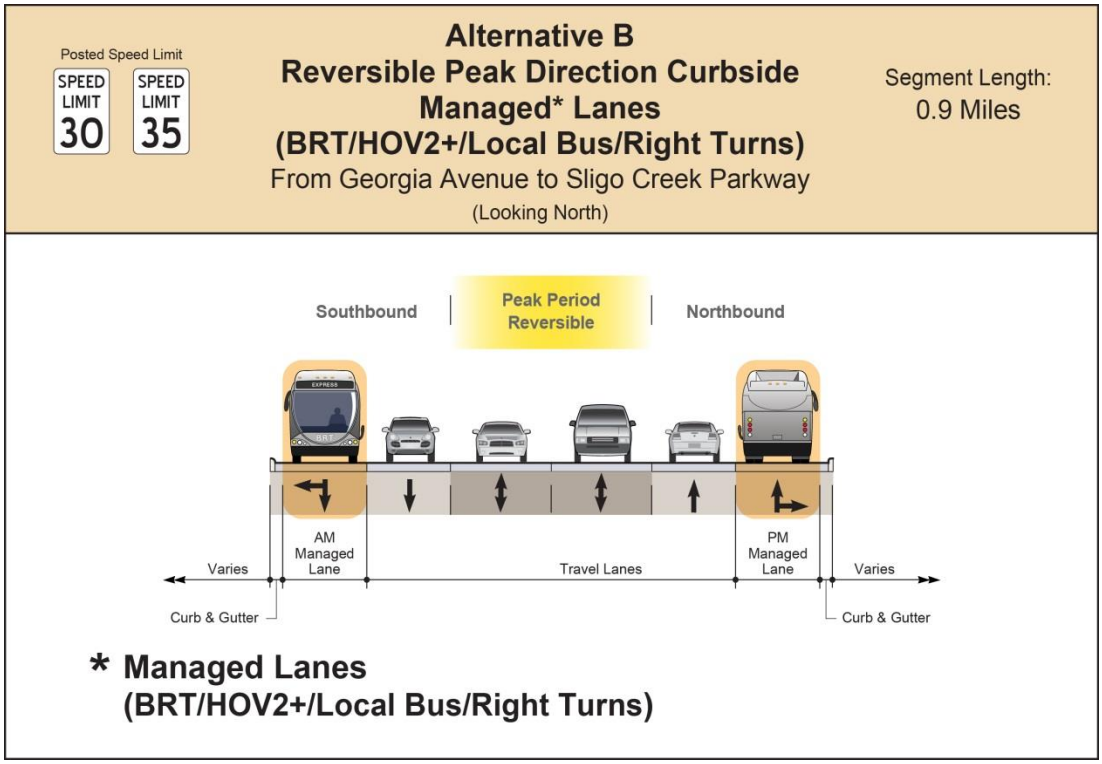
Section One: Silver Spring Transit Center to MD 97 / Fenton Street

- Buses would run in mixed traffic in southbound direction from Fenton Street to just south of MD 97 where buses will transition from the curb lane to the left lane to use the existing bus only lane to turn left into the Silver Spring Transit Center.
- Buses would run in mixed traffic in northbound direction from Silver Spring Transit Center to MD 97.
- A transition zone for northbound managed lane during p.m. peak period between MD 97 and Fenton Street would be provided.
- During off-peak times, northbound buses would run in mixed traffic from Silver Spring Transit Center to Fenton Street.
- Modifications to existing OVLS or new OVLS would be provided to communicate when managed lanes are active / inactive during peak and off-peak periods.
- Other managed lane signage and/or lane markings would be provided as needed.
- Existing left turn lanes and movements for general traffic would be maintained.

Section Two: MD 97 to Sligo Creek Parkway

- Managed lane in the peak direction during the peak period would be provided through repurposing of the peak direction curb lanes.
- Operation of existing reversible auto lanes would be maintained during peak periods.
- Off-peak direction buses would operate in mixed traffic during the peak period and off-peak period.
- Modifications to existing OVLS or new OVLS would be provided along with other signage / lane markings as needed.
- Left turn lanes and movements for general traffic would be maintained.

Figure 4-8a: Alternative B Reversible Peak Direction Curbside Managed Lanes (Section 2)



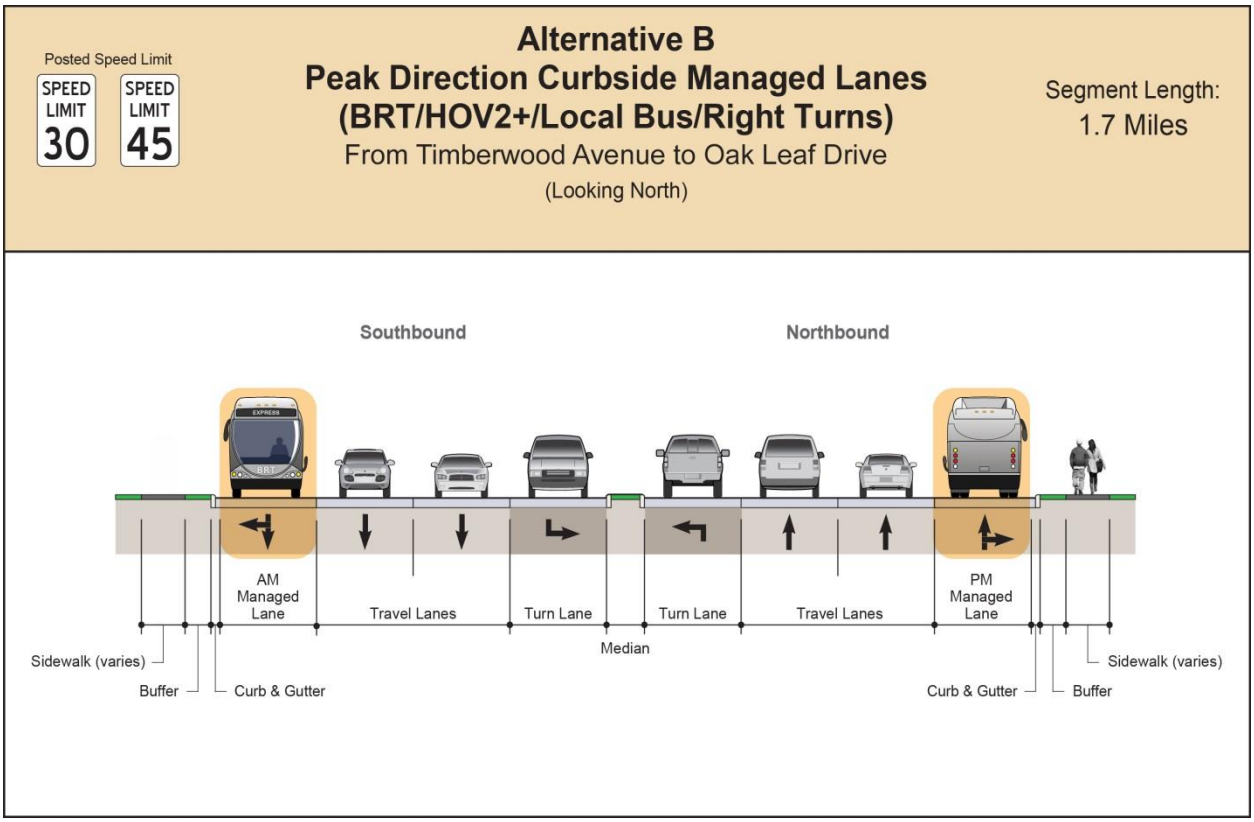
Section Three: Sligo Creek Parkway to Timberwood Avenue

- All lanes and vehicles would operate as mixed traffic at all times.
- BRT buses would remain in the mixed traffic curb lanes to access curbside stations at MD 193.

Section Four: Timberwood Avenue to Prelude Drive / Oak Leaf Drive

- Managed lanes would be provided in the peak direction through repurposing of the peak direction curb lanes.
- Off-peak direction buses would operate in mixed traffic.
- New OVLS and other signage / lane markings would be provided as needed.

Figure 4-8b: Alternative B Peak Direction Curbside Managed Lanes (Section 4)



Section Five: Prelude Drive / Oak Leaf Drive to Industrial Parkway

- All lanes and vehicles would operate as mixed traffic at all times.

Section Six: Lockwood Drive / Stewart Lane

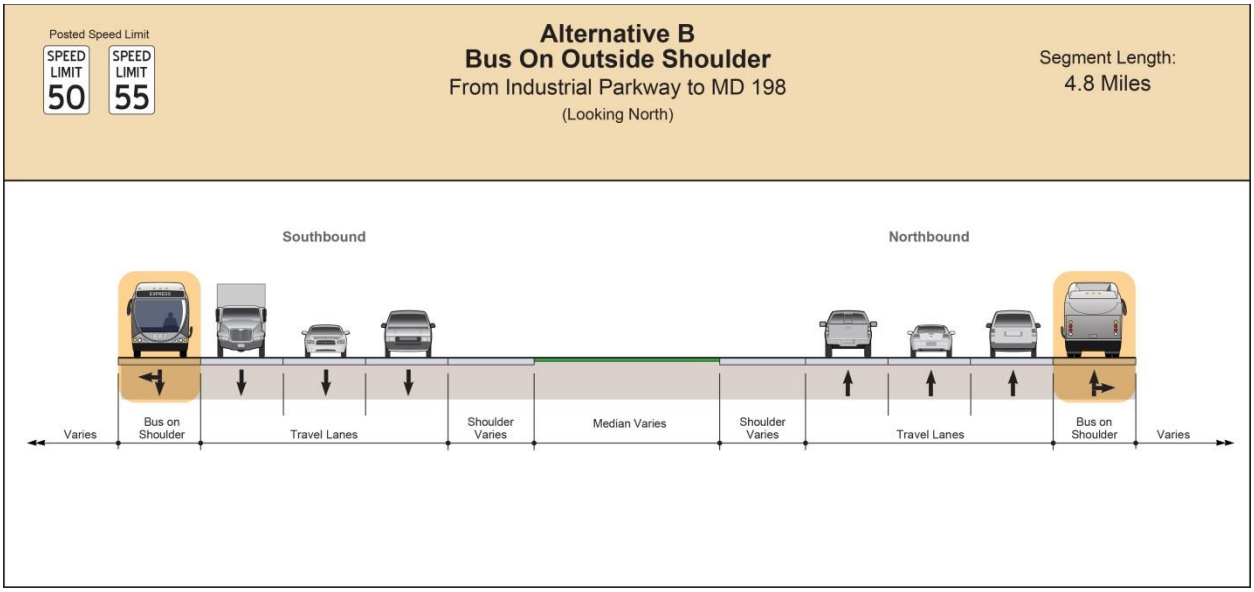
- All lanes and vehicles would operate as mixed traffic at all times.
- Dedicated bicycle lanes would be provided within existing pavement.
- Continuous sidewalk connections would be provided as needed.

Section Seven: Industrial Parkway to MD 198 and Burtonsville Park and Ride

- BRT, MTA Commuter, and local buses would be permitted to run on outside shoulder (match existing bus-on-outside-shoulder conditions) during peak periods and times traffic of congestion.

- All buses on outside shoulder would be limited to maximum speed of 35 mph and should not travel more than five mph faster than traffic in adjacent general traffic lanes.
- All buses would stay in general traffic lanes until travel speeds fall below 35 mph.
- All buses running on outside shoulders must yield to general traffic turning at intersections and entering and exiting at interchange ramps.
- BRT buses would run in mixed traffic between MD 198 to Burtonsville Park and Ride

Figure 4-8c: Alternative B Bus-On-Outside-Shoulder (Section 7)



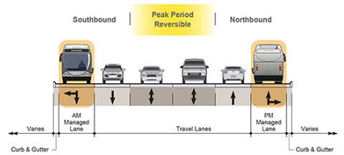
Section Eight: Briggs Chaney Road / Castle Boulevard

- All lanes and vehicles would operate as mixed traffic at all times.

Alternative B
Reversible Peak Direction Curbside Managed* Lanes
(BRT/HOV2+/Local Bus/Right Turns)
From Georgia Avenue to Sligo Creek Parkway
(Looking North)

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 35

Segment Length: 0.9 Miles

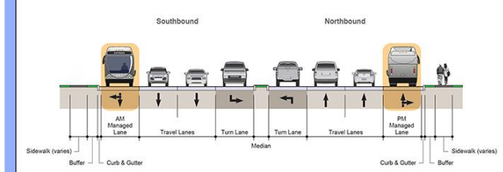


* Managed Lanes
(BRT/HOV2+/Local Bus/Right Turns)

Alternative B
Peak Direction Curbside Managed Lanes
(BRT/HOV2+/Local Bus/Right Turns)
From Timberwood Avenue to Oak Leaf Drive
(Looking North)

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 45

Segment Length: 1.7 Miles



Alternative B
Mixed Traffic

Posted Speed Limit: SPEED LIMIT 30 / SPEED LIMIT 50

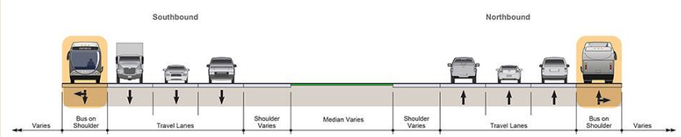
Segment Length: Varies

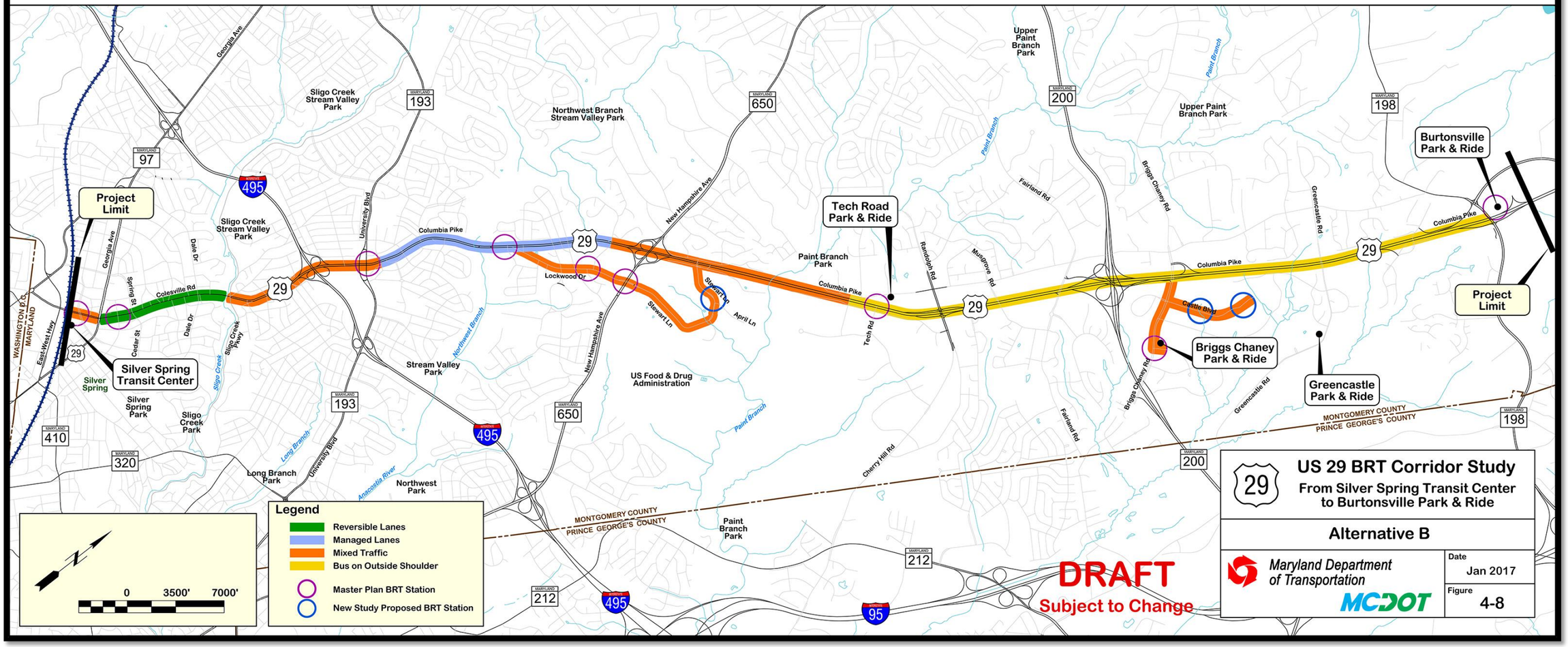
BRT IN MIXED TRAFFIC.
TYPICAL SECTIONS MATCH EXISTING CONDITIONS.

Alternative B
Bus On Outside Shoulder
From Industrial Parkway to MD 198
(Looking North)

Posted Speed Limit: SPEED LIMIT 50 / SPEED LIMIT 55

Segment Length: 4.8 Miles





DRAFT
Subject to Change

US 29 BRT Corridor Study
From Silver Spring Transit Center to Burtonsville Park & Ride

Alternative B

Maryland Department of Transportation MCDOT

Date: Jan 2017
Figure: 4-8

4.3.1.4 *Description of Alternative B Modified Running Way*

Alternative B Modified is a hybrid of features contained in Alternatives A and B. It incorporates the Alternative A median shoulder BRT lanes with the Alternative B managed lane (BAT/HOV2+) improvements. Alternative B Modified is slightly different than Alternative A in that the median shoulder BRT lanes would also be open to MTA Commuter buses. Local service would still be restricted to general purpose lanes. For description purposes, the alternatives are divided into geographical sections based on the specific running way improvements proposed in each section (see **Figure 4-9a, 4-9b, 4-9c, 4-9)**:

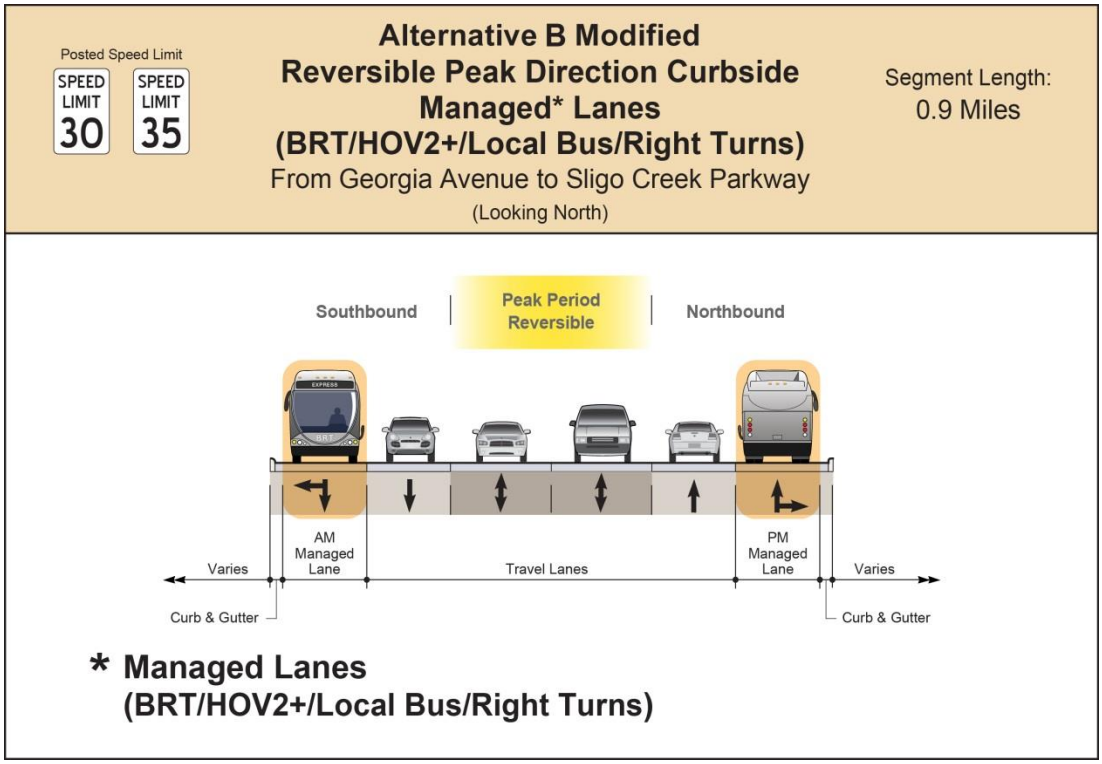
Section One: Silver Spring Transit Center to MD 97 / Fenton Street

- Buses would run in mixed traffic in southbound direction from Fenton Street to just south of MD 97 where buses will transition from the curb lane to the left lane to use the existing bus only lane to turn left into the Silver Spring Transit Center.
- Buses would run in mixed traffic in northbound direction from Silver Spring Transit Center to MD 97.
- A transition zone for northbound managed lane would be provided during p.m. peak period between MD 97 and Fenton Street.
- During off-peak times, northbound buses would run in mixed traffic from Silver Spring Transit Center to Fenton Street.
- Modifications to existing OVLS or new OVLS would be provided to communicate when managed lanes are active / inactive during peak and off-peak periods.
- Other managed lane signage and/or lane markings would be provided as needed.
- Existing left turn lanes and movements for general traffic would be maintained.

Section Two: MD 97 to Sligo Creek Parkway

- A managed lane in the peak direction would be provided during the peak period through repurposing of the peak direction curb lanes.
- Operation of existing reversible auto lanes during peak periods would be maintained.
- Off-peak direction buses would operate in mixed traffic during the peak period and off-peak period.
- Modifications to existing OVLS or new OVLS would be provided along with other signage / lane markings as needed.
- Left turn lanes and movements for general traffic would be maintained.

Figure 4-9a: Alternative B Modified Reversible Peak Direction Curbside Managed Lanes (Section 2)



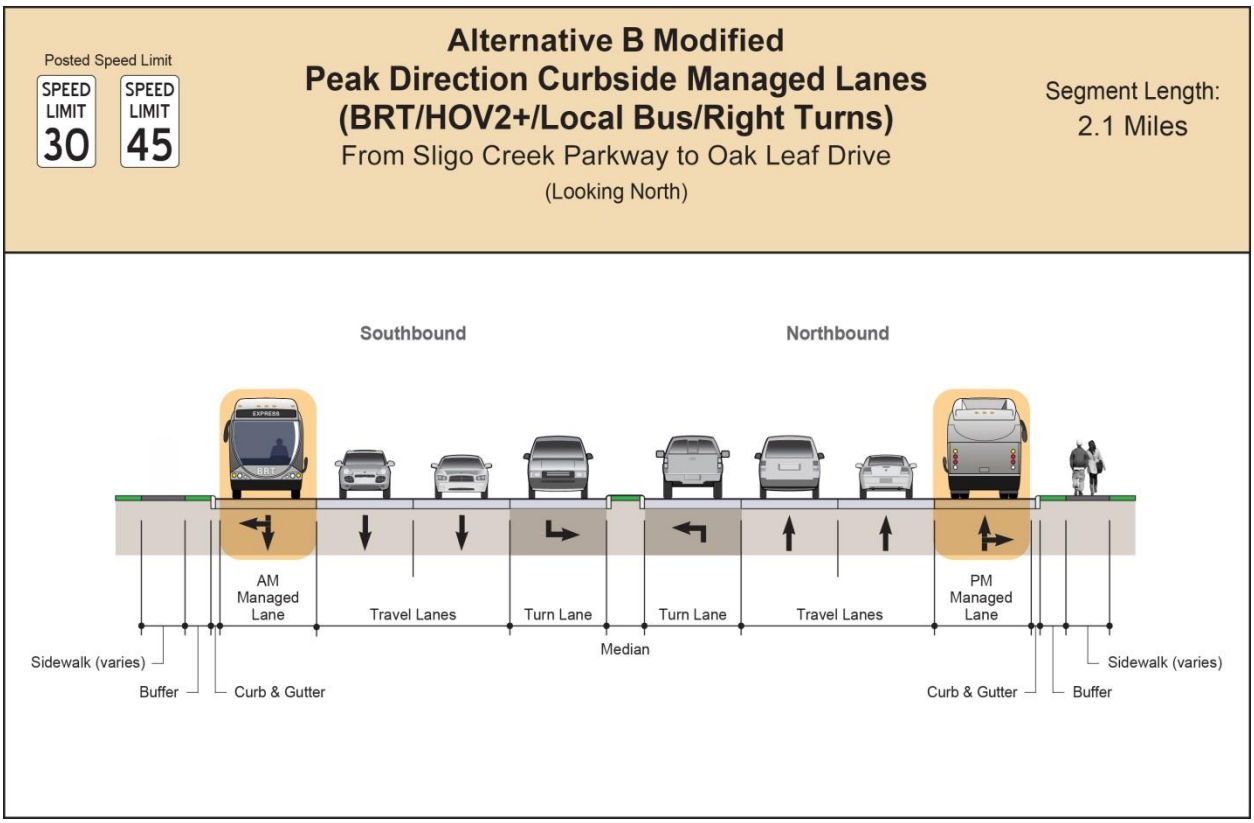
Section Three: Sligo Creek Parkway to Timberwood Avenue

- All lanes and vehicles would operate as mixed traffic at all times.
- BRT Buses would remain in the mixed traffic curb lanes to access curbside stations at MD 193.

Section Four: Timberwood Avenue to Prelude Drive / Oak Leaf Drive

- Managed lanes in the peak direction would be provided through repurposing of the peak direction curb lanes.
- Off-peak direction buses would operate in mixed traffic.
- New OVLS and other signage / lane markings would be provided as needed.

Figure 4-9b: Alternative B Modified Peak Direction Curbside Managed Lanes (Section 4)



Section Five: Prelude Drive / Oak Leaf Drive to Stewart Lane

- All lanes and vehicles would operate as mixed traffic at all times.
- Northbound BRT buses would transition from the curb lanes to the left lanes to access the proposed median shoulder BRT and Commuter Bus lanes at Stewart Lane.
- Southbound BRT buses would transition from median shoulder BRT and Commuter Bus lanes to curb lanes

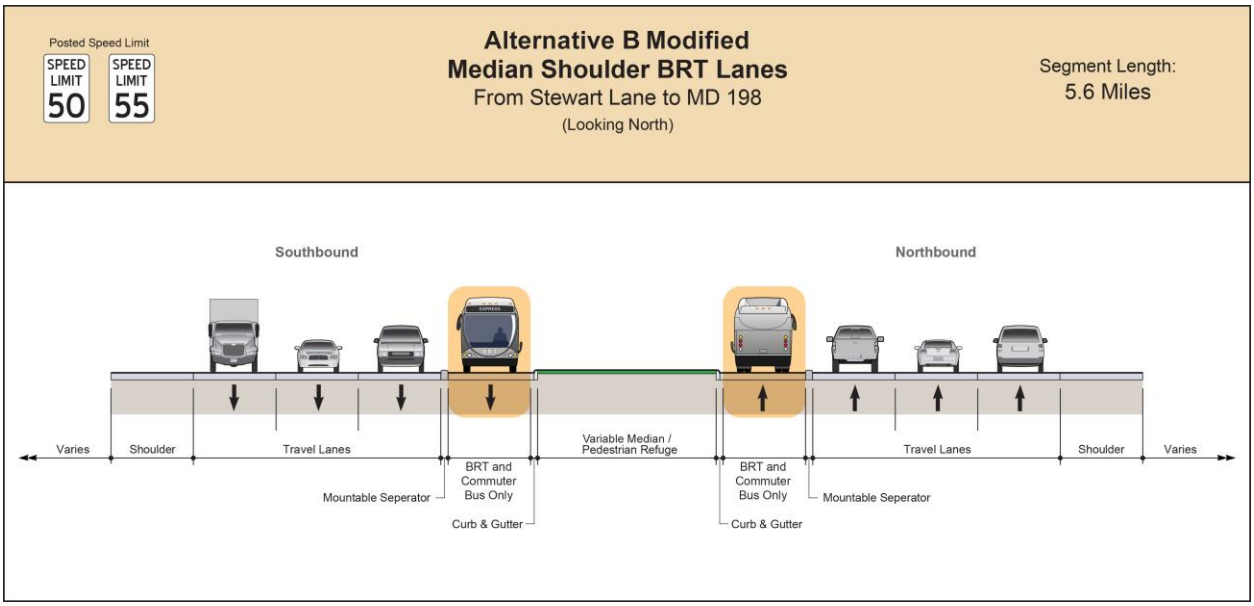
Section Six: Lockwood Drive / Stewart Lane

- All lanes and vehicles would operate as mixed traffic at all times.
- Dedicated bicycle lanes would be provided within existing pavement.
- Continuous sidewalk connections would be provided as needed.

Section Seven: Stewart Lane to MD 198 and Burtonsville Park and Ride

- New median shoulder BRT and Commuter Bus lanes would be constructed where needed and/or existing median shoulder would be widened as needed to accommodate BRT buses operating at highway speeds.
- Existing signalized intersections would be reconstructed to accommodate median shoulder BRT and Commuter Bus lanes while maintaining existing turn and through lane movements and configurations.
- Only BRT and MTA Commuter buses would have access to run in median shoulder BRT lanes as needed.
- BRT buses would run in mixed traffic between MD 198 to Burtonsville Park and Ride
- Signage and lane markings would be provided as needed.

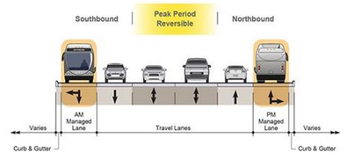
Figure 4-9c: Alternative B Modified Bus-On-Outside-Shoulder (Section 7)



Section Eight: Briggs Chaney Road / Castle Boulevard

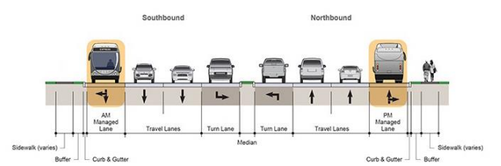
- All lanes and vehicles would operate as mixed traffic at all time.

Alternative B Modified
Reversible Peak Direction Curbside Managed* Lanes (BRT/HOV2+/Local Bus/Right Turns)
From Georgia Avenue to Sligo Creek Parkway
(Looking North)
Posted Speed Limit: 30 / 35
Segment Length: 0.9 Miles



* Managed Lanes (BRT/HOV2+/Local Bus/Right Turns)

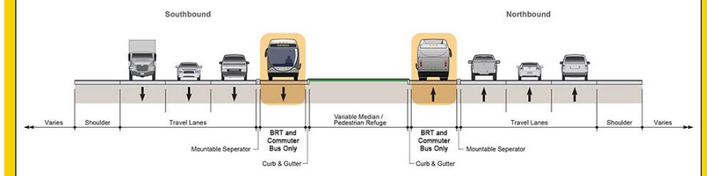
Alternative B Modified
Peak Direction Curbside Managed Lanes (BRT/HOV2+/Local Bus/Right Turns)
From Sligo Creek Parkway to Oak Leaf Drive
(Looking North)
Posted Speed Limit: 30 / 45
Segment Length: 2.1 Miles

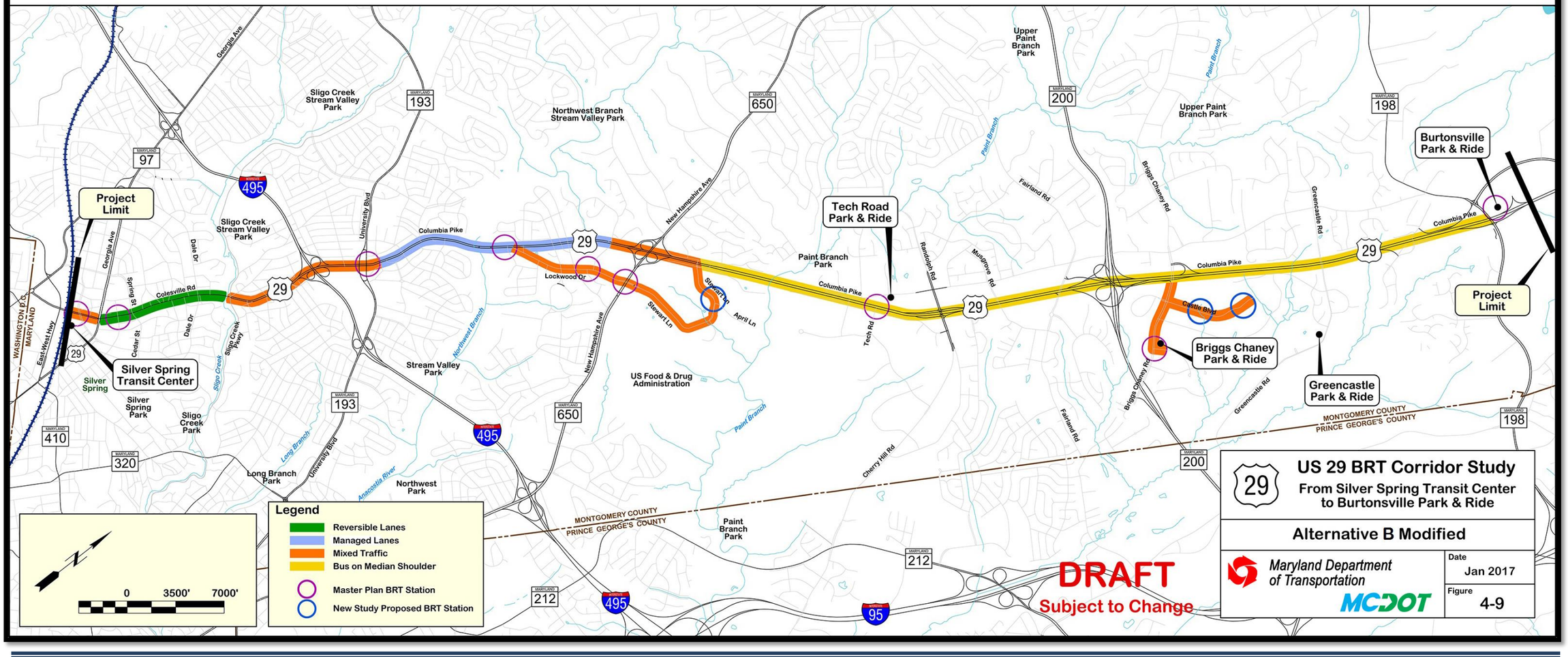


Alternative B Modified
Mixed Traffic
Posted Speed Limit: 30 / 45
Segment Length: Varies

BRT IN MIXED TRAFFIC.
TYPICAL SECTIONS MATCH EXISTING CONDITIONS.

Alternative B Modified
Median Shoulder BRT Lanes
From Stewart Lane to MD 198
(Looking North)
Posted Speed Limit: 50 / 55
Segment Length: 5.6 Miles





5 Affected Environment

This section documents the natural, socio-economic, and cultural resources, including both architectural and archeological resources, within the Study Area that could potentially be impacted by the proposed project. The information in this chapter is compiled from desktop research of readily available county, state and Federal data, and a windshield survey of the Study Corridor. Detailed environmental impact assessment and documentation are planned for a later phase of the study.

5.1 Natural Resources

Although the Study Area is largely urbanized and developed land, several significant areas containing natural resources are located throughout the US 29 Corridor. These areas include four main tributaries of the Anacostia River that cross through the US 29 Study Area: Sligo Creek, Northwest Branch (**Figure 5-1**), Paint Branch, and Little Paint Branch. Forests, floodplains, and nontidal wetlands are also associated with some of these stream systems.

Figure 5-1: Northwest Branch, looking towards the southeast

There is no federal or state parkland located within the Study Area. One water supply park, the T. Howard Duckett Watershed, is owned by the Washington Suburban Sanitary Commission (WSSC) and is located just north of the study limits. All other parkland within the Study Area is owned by the M-NCPPC. See Section 4(f) discussion below for a detailed list of the parklands. See the Project Overview Figures (see **Figures 5-3, 5-4, 5-5, and 5-6**) for details on natural resources locations. The following sections provide detail on the Study Area surrounding natural environment.

5.1.1 Topography, Geology, Soils & Groundwater

The Study Area is located within the Upland Section, or northern division of the Piedmont Plateau physiographic province. The Piedmont Region is further divided into sub regions, with the US 29 BRT Study Area falling within the Major Land Resource Area (MLRA) 148 of Land Resource Region (LRR) south (S) (USACE, 2012). The Study Area is underlain by older metamorphic and igneous formations. The U.S. Army Corp of Engineers (USACE) uses these MLRA regions in the determination of wetland indicators in conjunction with delineation methodologies. These regions are largely affected by climatic conditions and the physical and biological characteristics of the landscape. In general, groundwater in these regions can be found in consolidated rock fractures, or weathered rock. The Study Area lies between two principle aquifers, the Piedmont and Blue Ridge Crystalline-Rock Aquifer and the Northern Atlantic Coastal Plain Aquifer System (see **Figure 5-2**) (USGS, 2003). Generally, these aquifers are the underground reservoirs that store and yield groundwater.

Twenty different soil map units are present within the Study Area. Two of these soils, Hatboro silt loam and Baile silt loam, are listed as hydric in the *Hydric Soils of the U.S*. (USDA SCS, 1991). These soils can be found within the study limits along the Paint Branch and Little Paint Branch stream crossings. These hydric soils have formed under conditions of saturation, flooding, or ponding for long enough periods during the growing season that anaerobic conditions have developed in the upper soil profile (USACE, 2012). Erodibility of a soil is expressed as a K-value, which ranges from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to water erosion. **Table 5-1** summarizes the soil map units present in the Study Area and its physical characteristics, with several soils indicating the upper spectrum of erodibility. Factors such as soils erodibility, susceptibility to flooding, depth to restrictive layers and water table are all important considerations should construction activities result in soil disturbance.

Figure 5-2: Watershed and Aquifer Boundaries

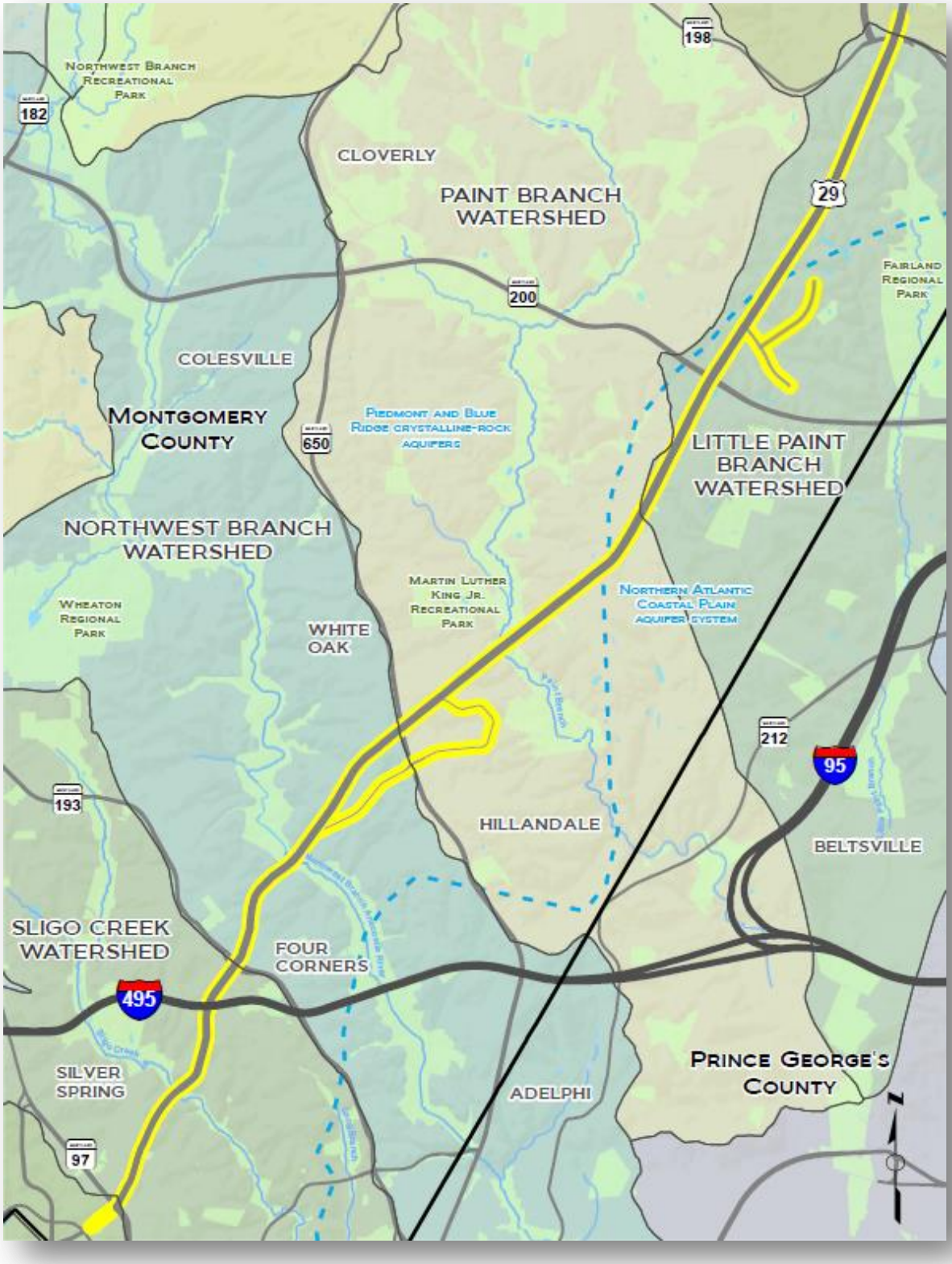


Table 5-1: Map Unit Characteristics of Soils Occurring within the Study Area

Map Unit	Map Unit Name	% Slope	Erodibility	Hydric (Y or N)
1B	Gaila silt loam	3-8	0.24-.037	N
1C		8-15		
2B	Glenelg silt loam	3-8	0.32-0.49	N
2C		8-15		
2UB	Glenelg-Urban land complex	0-8	0.32-0.49	N
2UC		8-15		
5A	Glenville silt loam	0-3	0.24-0.32	N
5B		3-8		
6A	Baile silt loam	15-25	0.43	Y
16D	Brinklow-Blocktown channery silt loams	0-3	0.28	N
53A	Codorus silt loam occasionally flooded	0-3	0.49	N
54A	Hatboro silt loam frequently flooded	0-3	0.49	Y
55C	Evesboro loamy sand	3-15	0.17	N
57B	Chillum silt loam	3-8	0.17-0.43	N
57C		8-15		
57D		15-25		
57UB	Chillum-Urban land complex	0-8	0.43	N
58B	Sassafras loam	3-8	0.17-0.37	N
58C		8-15		
59A	Beltsville silt loam	0-3	0.32-0.43	N
59B		3-8		

Table 5-1: Map Unit Characteristics of Soils Occurring within the Study Area, Continued

Map Unit	Map Unit Name	% Slope	Erodibility	Hydric (Y or N)
61B	Croom gravelly loam	3-8	0.17-0.43	N
61C		8-15		
61D		15-25		
61E		25-40		
61UB	Croom-Urban land complex	0-8	0.43	N
65B	Wheaton silt loam	0-8	0.49	N
66UB	Wheaton-Urban land complex	0-8	0.37-0.49	N
66UC		8-15		N
67UB	Urban land-Wheaton complex	0-8	0.49	N
116D	Blocktown channery silt loam, very rocky	15-25	N/A	N
116E		25-45		
400	Urban land	N/A	N/A	N

5.1.2 Surface Water Resources, Water Quality & Floodplains

The Study Area is located entirely within the Anacostia River watershed, spanning from the watershed's northern most boundary to the southern limit. There are four main tributaries of the Anacostia River and sub-basins of the Anacostia that cross through the Study Area, including Sligo Creek, Northwest Branch, Paint Branch, and Little Paint Branch (See **Figure 5-2**).

Sligo Creek is the southernmost stream that crosses the Study Area, just north of downtown Silver Spring and south of I-495 (Capital Beltway). Sligo Creek is designated a Use I stream (i.e., suitable for water recreation and support of aquatic life) by Maryland Department of the Environment (MDE). The condition of fish and macroinvertebrate populations in Sligo Creek has improved due to restoration efforts. However, aquatic resources still remain heavily impacted. Sligo Creek is one of the most urbanized sub-watersheds within the Maryland portion of the Anacostia watershed; with approximately 90 percent of the total subwatershed area being developed and only about 35 percent of the stream corridor characterized by riparian forest

buffer. In general, the overall health of the macroinvertebrate and fish communities in Sligo Creek can be characterized as poor to good (MWCOG, 2009).

The Northwest Branch crosses the Study Area north of I-495 and south of MD 650 (New Hampshire Ave), and it is designated as a Use IV stream (recreational trout waters) by the MDE. Many efforts to stock the stream and provide an established brown trout population are ongoing by the MDNR, and joint efforts by the Maryland Department of Natural Resources (MDNR) and the M-NCPPC have now introduced fingerling smallmouth bass in the vicinity of I-495 and the Study Area portion of the Northwest Branch. Today this waterway supports a self-reproducing smallmouth bass fishery (MWCOG, 2009).

The Paint Branch subwatershed is generally bound by MD 198 (Sandy Spring Road/Spencerville Road) to the north, US 29 and Cherry Hill Road to the east, US 1 and College Park Airport to the southeast and MD 650 (New Hampshire Avenue) to the west. The entire Paint Branch subwatershed upstream of the Capital Beltway and within the Study Area has been designated by MDE as Use III (natural trout waters). The Paint Branch is considered the Anacostia watershed's highest quality stream system, and it has supported a naturally reproducing brown trout population since the 1930s. In general, the overall health of the aquatic community in the Paint Branch can be characterized as being poor-to-good for macroinvertebrates and poor to excellent for fish (MWCOG, 2009).

The Little Paint Branch subwatershed is primarily located in the Coastal Plain physiographic province, with only the northern most tributaries located in the Piedmont and crossing the northern most portion of the Study Area. Little Paint Branch is designated a Use I stream, suitable for water recreation and support of aquatic life. In general, the overall health of the macroinvertebrate and fish communities in Little Paint Branch can be characterized as ranging from very poor to good. It has been known to support sensitive species such as mayflies, stoneflies, and caddisflies (MWCOG, 2009).

Data from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps was obtained to identify 100-year floodplains within the Study Area (FEMA, 2011). Records indicate 100-year floodplain associated with the main-stem crossings of Sligo Creek, Northwest Branch, and Paint Branch.

5.1.3 Total Maximum Daily Loads and MS4 Permit

A Total Maximum Daily Load (TMDL) calculates the maximum amount of a pollutant that a waterbody can receive while still meeting water quality standards. Section 303(d) of the Clean Water Act requires that a TMDL be developed for the pollutant(s) responsible for impairing a waterbody. Each state compiles a list, which identifies the impaired waterbodies contained

within their state, and further broken down into Counties. Currently 733 waters are identified as impaired in the State of Maryland (MDE, 2006), and within the Anacostia River Watershed the Environmental Protection Agency approved TMDLs include bacteria, nutrients, sediment, trash, and Polychlorinated Biphenyls (PCBs).

As the Study Area is largely urbanized, stormwater off of the roads, sidewalks, parking lots and surrounding area makes its way into the storm drains and eventually into the streams. The federal government regulates stormwater through the Municipal Separate Storm Sewer System Permit Program (MS4 Permit Program). This permit requires that the county meet certain water quality standards. The permit is given every five years and progress of the county is monitored.

5.1.4 Waters of the U.S. including Wetlands

According to published resources of the National Wetlands Inventory (NWI) and U.S. Geological Survey (USGS), several wetland systems are identified within and surrounding the Study Area. To supplement desktop research, a wetland corridor "windshield" identification study was conducted in the fall of 2014, throughout the entire Study Area, to field verify the presence of wetlands and waters identified by the NWI and USGS databases, as well as locate any areas where potential jurisdictional wetlands or waters may be located. Identified features were sketched onto field mapping and illustrated in the Project Overview Figures (see **Figures 5-3, 5-4, 5-5, and 5-6**), as Observed Wetlands. These are described below as "potential" wetland systems, as sample data points and tests for specific wetland criteria have not been performed and confirmation of wetland status determined.

North of MD 650, and within a 200-foot wide natural resource Study Area, there are several small NWI wetland systems. Four of these wetlands no longer exist and therefore were removed from the mapping. Based on the windshield field survey, an additional nine potential wetland systems were identified within the Study Area. Hydric soils, hydrophytic vegetation, and hydrology were all noted at each location. The following summarizes the findings:

- Three potential palustrine forested wetland (PFO) systems identified along the west side of Wexhall Drive, parallel to US 29.
- One potential PFO identified near US 29 within an existing forest conservation easement.
- Two potential palustrine emergent (PEM) wetlands identified on the east side of US 29 in the vicinity of Randolph Road.
- One potential linear PEM identified along northbound US 29 just north of Stewart Lane.

- Two potential PFO wetlands identified along southbound US 29, one at Prelude Drive and one within Sligo Creek Stream Valley Park.

In addition to readily available published wetland information and field observed wetlands, surveyed wetlands are also located on the attached mapping. These surveyed wetlands have been completed by the SHA or other consultant firms, for other various projects whose study areas coincide with the US 29 BRT Study Area.

In addition to the wetland systems identified, a total of six streams were identified by MDNR as crossing under US 29 within the Study Area; Sligo Creek, Northwest Branch, Paint Branch, and three small tributaries associated with Little Paint Branch. Field investigations confirmed all of these perennial stream crossings. Several potential intermittent and ephemeral streams associated with these large perennial waters are also located within the Study Area. Areas of roadside grass swales and channels that were not connected to waters of the U.S. were not mapped.

Field delineations completed in accordance with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, Version 2.0* (USACE, November 2012) would be required to confirm the exact limits of all waters of the U.S., including wetlands, in the Study Area.

5.1.5 Vegetation and Wildlife

Much of the Study Area is occupied by residential land uses, with areas of commercial centers focused around the major intersections and towns. The existing forest within and immediately adjacent to the Study Area is largely associated with the major stream crossings within existing M-NCPPC parkland: Sligo Creek Stream Valley Park; Northwest Branch Stream Valley Park; and the Upper Paint Branch Stream Valley Park. The forested stream buffers associated with these systems consist of largely mid to late successional deciduous forest of the Oak-Northern Hardwoods Forest Association and are dominated by white oak, northern red oak, black oak, tulip poplar, red maple, green ash, American sycamore, and American beech. The canopy species in the mid-successional forest are primarily within the 16 to 28-inch diameter at breast height (dbh) size class throughout the Study Area with larger trees scattered throughout. Much of the canopy functions as important cover over stream valleys, helping to maintain water quality and habitat within the stream channels.

Approximately two dozen specimen trees (trees greater than 30 inches dbh or 75 percent of the state champion) were observed during the windshield survey. However, there is the potential for specimen trees within the forest interior that was not visible during the survey, and in

private residential areas. Many of these specimen trees were identified in the southern portion of the Study Area. A moderately diverse understory of shrubs and saplings is present within these larger forest tracts.

In addition to the parkland forest areas, there are street trees, forest fragments, and naturally regenerating areas present in several locations throughout the corridor. Several of these areas contain early to mid-successional forests dominated by tulip poplar, red maple, silver maple, American beech, and black cherry, of approximately 12 to 18" dbh. Additional common tree species include persimmon, white pine, Virginia pine, and along several roadway edges, tree-of-heaven, Hawthorne, Bradford pear, and black locust.

All of the observed forested areas contain a high percentage of invasive plants, particularly vines that in some cases have grown into the canopy layer. The abundance of vines suggests a high amount of light availability, which often results from forest fragmentation. Japanese honeysuckle and greenbrier are prevalent in almost all forested locations throughout the Study Area. Oriental bittersweet, poison ivy, and English ivy are also commonly found.

If the conceptual build alternatives require the cutting or clearing of forest greater than one acre, the Maryland Reforestation Law requires that these trees be replaced on an acre-for-acre, one to one ratio on public lands and within two years, or three growing seasons of the completion of the project. If the proposed conceptual build alternatives require less than one acre of tree clearing, information will need to be provided to the MDNR identifying trees to be impacted and documented under their existing Roadside Tree Blanket Permit.

According to MDNR Geographic Information System (GIS) information, there are several locations of Forest Interior Dwelling Species (FIDS) habitat identified within the Study Area. FIDS typically require large tracts of forest in which to maintain viable populations. FIDS habitat was identified on the west side of US 29 within the forested stream buffer in Sligo Creek Stream Valley Park; both the east and west of US 29 within the Northwest Branch Stream Valley Park and the Paint Branch Stream Valley Park; and a small portion adjacent to the east side of US 29 along the Little Paint Branch. Coordination with the MDNR Wildlife and Heritage Service is necessary if any impacts to FIDS are proposed.

The Study Area is a very densely populated area, especially in the southern portion of the Study Area; therefore, the opportunity for wildlife use is limited, and largely confined to relatively narrow corridors. The existing parkland provides the most abundant habitat available for wildlife, as well as additional local parks in the vicinity of the Study Area. However, the local parks also play host to community activities thus limiting wildlife. Observed wildlife include squirrels, song birds, and falcons, with other evidence of beavers and raccoons.

5.2 Section 4(f) and Cultural Resources

5.2.1 Section 4(f) Resources

Section 4(f) of the U.S. Department of Transportation Act of 1966, 49 USC 303(C) protects publicly owned parks, recreation area, wildlife management areas, scenic and wild rivers, or state wildlands, as well as significant public or privately owned historic sites. Evaluation of all 4(f) resources within the Study Area must be done to determine the use of the Section 4(f) resource. It requires that the agencies identify and evaluate 4(f) resources and take steps to avoid, minimize, and mitigate any use on these resources.

The Study Area crosses three M-NCPPC Stream Valley Parks (SVPs) as well as adjacent local parks and conservation areas all owned by the M-NCPPC, including the following:

- Gene Lynch Urban Park
- Ellsworth Urban Park
- Sligo Creek Stream Valley Park
- Hastings Neighborhood Conservation Area
- Northwest Branch Stream Valley Park
- Burnt Mills West Special Park
- Paint Branch Stream Valley Park
- Martin Luther King Jr. Recreational Park
- Stonehedge Local Park
- Calverton Neighborhood Conservation Area
- Stonecrest Neighborhood Conservation Area

In addition to the identified parks, publicly owned schools often have facilities, such as playground or athletic facilities that are open to the public. Several schools have property that directly abuts the US 29 right-of-way: Montgomery Blair High School, Paint Branch High School, and the Fairland Center. Montgomery Blair High School and Paint Branch High School are currently active. The Fairland Center has been identified as both the formerly Glenallen Elementary School, and the historic Fairland School. The site consists of two parcels, a north and south, which are both owned by the Board of Education. It is not currently used as an elementary school. However, local groups use the open fields at the site for sporting events. Parklands and community facilities are illustrated on Project Overview Figures (see **Figures 5-3, 5-4, 5-5, and 5-6**).

There is the potential that sidewalk uses and/or park entrances could be altered, depending on final design and bus stop locations. Any encroachment onto these park properties will require further coordination with the M-NCPPC. If federal funds are used for this project, any encroachment on a publicly-owned and used park or recreation area will require development

and evaluation of avoidance and minimization alternatives under Section 4(f) of the USDOT Act of 1966. There are no wildlife management areas, scenic rivers, or state wildlands located within or adjacent to the Study Area.

5.2.2 Architectural Resources

Historic resources that are eligible for or listed in the National Register of Historic Places are protected by the provisions of Section 106 of the National Historic Preservation Act (36 CFR Part 800) and the Maryland Historical Trust Act of 1985 (as amended, §§ 5A-325 and 5A-326 of the Annotated Code of Maryland). These state and federal regulations require that agencies identify and evaluate historic properties listed or eligible for listing in the National Register of Historic Places (NRHP) with potential to be affected by their proposed infrastructure elements. In addition, agencies must consult with the stakeholders including the Maryland Historical Trust (MHT) and State Historic Preservation Office (SHPO) to take steps to avoid, minimize, and mitigate the adverse effects of undertakings on these resources.

SHA cultural resource professionals reviewed the SHA-GIS Cultural Resources Database, the MHT Digital Library, property tax information, and aerial photographs to develop a preliminary inventory for the proposed US 29 BRT project. These references were reviewed for historic architectural and archaeological resources within approximately 200 feet on either side of US 29, the same approximate study limits for the environmental inventory. US 29 from Silver Spring to the Howard County Line runs primarily in a northeast direction and through highly built-out suburban development. The surrounding development is generally older the closer to the DC, with early twentieth century development in Silver Spring. US 29 is known as Colesville Road in Silver Spring and the roadway and surrounding development has an urban character.

The Study Area contains multiple properties that have been inventoried during historic resource surveys and entered into the Maryland Inventory of Historic Properties (MIHP) database. A compilation of those resources is listed in **Table 5-2**. Of those historic resources on the MIHP, some resources have not been evaluated for NRHP eligibility, but most have had eligibility determinations and have been listed, determined eligible, or determined not eligible for the NRHP. Ove of the resources (the Silver Theater and Silver Spring Shopping Center, M:36-7-1) has preservation easements on the property.

Table 5-2: MIHP Resources and Preservation Easements

MIHP Number	Resource Name	Town	NRHP Eligibility
M: 15-88	Henry S. Krusen House (Bricefield Property)	Burtonsville	Not Eligible (demolished)
M: 32-05	Polychrome Historic District (Polychrome Houses)	Woodmoor	Listed NR-1169
M: 32-7	Argyle Park Neighborhood	Silver Spring	Not Eligible
M: 32-11	North Hills of Sligo Park	Silver Spring	Not Eligible
M: 32-12	Indian Spring Club Estates/Indian Spring Terrace/Indian Spring Manor	Silver Spring	Not Eligible
M: 32-15	Sligo Creek Parkway	Silver Spring, Takoma Park, Hyattsville	Eligible
M: 32-16	Fairway, Chalfonte, Country Club Park, Country Club View	Silver Spring	Not Eligible
M: 32-21	Choi Property	Silver Spring	Not Eligible
M: 33-22	Robert B. Morse Water Filtration Plant	Woodmoor	Eligible
M: 33-26	Bridge 15035	Silver Spring	Eligible
M: 33-27	Bridge 15009, Burnt Mills Bridge	Woodmoor	Not Eligible
M: 34-3	Pease House (Duvall House)	Burtonsville	Not Evaluated (demolished)
M: 34-18	Carroll House (John Hardesty Property)	Burtonsville	Not Eligible
M: 34-19	Samuel S. Aitcheson House (Walter Fehr Property)	Burtonsville	Not Eligible
M: 34-21	Willard Marlow House I & II (William Ellin Property)	Colesville	Not Eligible
M: 34-39	John Hardisty House	Burtonsville	Not Eligible (demolished)
M: 34-40	Jackson Yang Property	Burtonsville	Not Eligible
M: 34-41	Carroll and V.E. Ricketts Property	Burtonsville	Not Eligible
M: 34-43	Stephen C. Beaver III House	Silver Spring	Not Eligible
M: 34-53	Fairland Data Center	Silver Spring	Not Eligible
M: 35-142	Georgetown Branch, B&O Railroad	Chevy Chase	Not Eligible
M: 36-7	Old Silver Spring Commercial Area	Silver Spring	
M: 36-7-1	Silver Theatre and Silver Spring Shopping Center	Silver Spring	Eligible
M: 36-7-1	Preservation Easement, Silver Spring Shopping Center (E-568)	Silver Spring	not applicable (n/a)

Table 5-2: MIHP Resources and Preservation Easements, Continued

MIHP Number	Resource Name	Town	NRHP Eligibility
M: 36-7-1	Preservation Easement, Silver Theatre (E-581)	Silver Spring	n/a
M: 36-7-2	Montgomery Arms	Silver Spring	Eligible
M: 36-7-3	J.C. Penney Co. Building	Silver Spring	Facadectomy
M: 36-7-4	City Springs (No Documentation on File)	Silver Spring	Not Evaluated
M: 36-9	Mrs. K's Toll House	Silver Spring	Not Evaluated
M: 36-18	Woodside Park Historic District	Silver Spring	Not Evaluated

Source: MIHP database

In addition, many other properties over forty-five years of age are located adjacent to the project limits that have not been previously inventoried or evaluated for the NRHP. These unevaluated properties include, but are not limited to, the following:

- Calverton Neighborhood
- 12721 Deer Park Drive
- Rolling Acres, Section 1
- Springbrook Village
- 1302 Milestone Drive
- Burnt Mills Townhouses (1968)
- Burnt Mills Village
- Burnt Mills Manor
- Woodmoor
- Northwood Park View
- Northwood Park
- Indian Spring View
- Four Corners Commercial Area
- Seven Oaks
- South Woodside Park
- Bridge 151010
- First India United Methodist
- Silver Spring Library
- 8915 Colesville Road
- Colesville Towers Road
- 1000 Noyes Drive
- 8808 Colesville Road
- Colespring Plaza, 1001 Spring Street
- Spring-Colesville Parking Garage, 1000 Spring Street
- 8728 Colesville Road
- 8727 Colesville Road
- 8501 Colesville Road

5.2.3 Archeological Resources

A review of existing cultural resource databases reveals that no archeological sites have been recorded within the Study Area, and no archeological surveys have been conducted for the Study Area. The following inventoried properties are located within the project Study Area:

- 18MO271 (Stewart Lane and Old Columbia Pike)
- 18MO481, 18MO482 (Paint Branch)
- 18MO609 (site was mitigated for the ICC and has been destroyed)
- 18MO272 (near Randolph Road)
- 18MO274 (near Little Paint Branch)

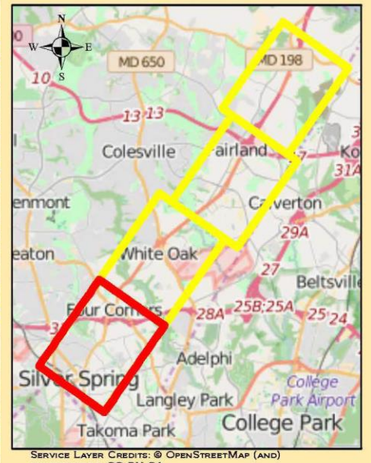
Much of the Study Area has been developed for commercial or residential purposes. However, the Study Area may include undisturbed terrain at the crossings of major streams, including Paint Branch and Northwest Branch. Phase I archeological survey may be warranted, if right-of-way acquisition is required within high potential areas overlooking stream crossings. However, this preliminary conclusion will need to be re-evaluated once project plans are available, to make a conclusive determination.

US Route 29 Bus Rapid Transit (BRT)

Figure 5-3
Project Overview

Montgomery County RAPID TRANSIT US 29

Vicinity Map



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DoIT, MD iMAP, MDP

Legend

- Study Corridor
- Federal Land
- NWI Wetlands
- USGS Waters
- Forest Conservation Easements (FCE)
- Archeological Sites (Site)
- Historic Survey Sites (Hist)
- National Register of Historic Places (NRHP) Listed or Eligible (Hist)
- Floodplain
- Parks (Park)
- Observed Wetland
- Observed Stream
- Specimen Tree

1 inch = 1,000 feet

0 500 1,000 2,000 Feet

Maryland Department of Transportation MDOT

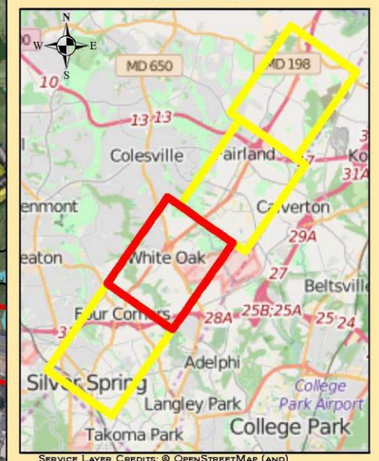
Community Facilities	Educational Facilities	Religious Facilities	Religious Facilities Continued	Emergency Facilities
C-1. Mont. Co. Department of Health & Housing Services	E-1. Sligo Creek Elementary School	R-1. RCCG Jesus House DC	R-7. Memorial First India United Methodist Church	X-1. Silver Spring Fire Department - Station 1
C-2. City Place Mall	E-2. Silver Spring International Middle School	R-2. First Baptist Church Of Silver Spring	R-8. Christ Congressional Church	
C-3. Silver Spring Civic Center at Veterans Place	E-3. High School and View Elementary School	R-3. Seventh Day Adventist Church	R-9. Knox Orthodox Presbyterian Church	X-2. Montgomery Co. 3rd District Police Dept.
C-4. Silver Spring Library	E-4. Montgomery Blair High School	R-4. Silver Spring United Methodist Church	R-10. The Revelation Universal Evangelical Ministries	
C-5. YMCA Youth & Family Services	E-5. St. Bernadette School	R-5. Iglesia Evangelica Apostoles Y Profetas	R-11. Silver Spring United Methodist Cooperative Parish	X-3. Silver Spring Volunteer Fire Station 16
C-6. YMCA Silver Spring Youth Services	E-6. Pine Crest Elementary School	R-6. St Luke Lutheran Church	R-12. Saint Bernadette Roman Catholic Church	
C-7. U.S. Post Office - Woodmoor Station			R-13. Nichiren Shosu Myosenji Buddist Temple	
C-8. National Children's Center - Silver Spring Masonic Temple				

US Route 29 Bus Rapid Transit (BRT)

Figure 5-4
Project Overview

Montgomery County RAPID TRANSIT US 29

Vicinity Map



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DoIT, MD iMAP, MDP

Legend

- Study Corridor
- Federal Land
- NWI Wetlands
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- Forest Conservation Easements (FCE)
- Archeological Sites (Site)
- Historic Survey Sites (Hist)
- National Register of Historic Places (NRHP) Listed or Eligible (Hist)
- Floodplain
- Parks (Park)
- Observed Wetland
- Observed Stream
- Specimen Tree

1 inch = 1,000 feet

0 500 1,000 2,000 Feet

Maryland Department of Transportation MDOT

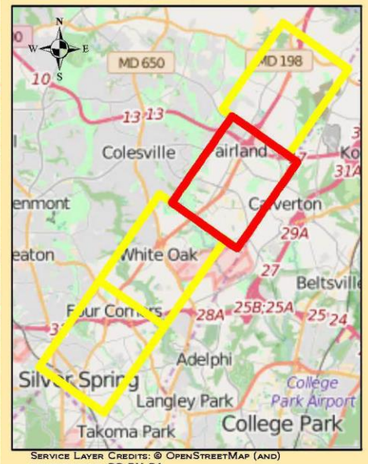
Community Facilities	Educational Facilities	Religious Facilities	Emergency Facilities
C-1. West Hillandale Swim Club	E-1. Francis Scott Key Middle School	R-1. Southeast Hebrew Congregation	
C-2. Northwest Branch Swim Club - Rec Center	E-2. Cresthaven Elementary School	R-2. Burnt Mills Seventh-Day Adventist Church	X-1. Hillandale Volunteer Fire Department Station 12
C-3. Rachel Carson Council, Inc, Library	E-3. The Greater Washington Community Kollel	R-3. Jesus Christ is The Lord Universal Church	
C-4. White Oak Library	E-4. Burnt Mills Elementary School	R-4. Kingdom Hall of Jehovah Witnesses	X-2. Montgomery County 3rd District Police Station
C-5. White Oak Community Recreation Center	E-5. White Oak Middle School	R-5. St Stephen Lutheran Church	
C-6. Martin L. King Jr. Swim Center	E-6. Jackson Road Elementary School	R-6. Our Lady of Vietnam Parish	

US Route 29 Bus Rapid Transit (BRT)

Figure 5-5
Project Overview

Montgomery County RAPID TRANSIT US 29

Vicinity Map



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DoIT, MD iMAP, MDP

Legend

- Study Corridor
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- NWI Wetlands
- USGS Waters
- FCE Forest Conservation Easements
- Site Archeological Sites
- Hist Historic Survey Sites
- Hist National Register of Historic Places (NRHP) Listed or Eligible
- Floodplain
- Park Parks
- Observed Wetland
- Observed Stream
- Specimen Tree

1 inch = 1,000 feet

0 500 1,000 2,000 Feet

Maryland Department of Transportation MDOT

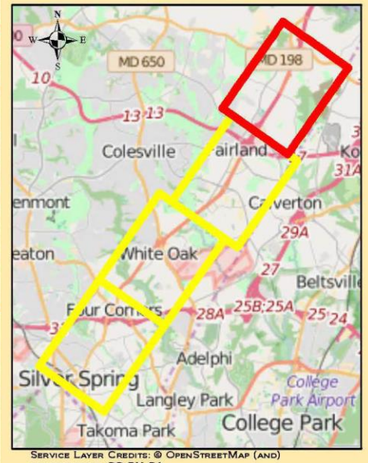
Community Facilities	Educational Facilities	Religious Facilities	Religious Facilities Continued	Emergency Facilities
C-1. Park and Ride	E-1. MCPS West Farm Depot and Vehicle Maintenance Facility	R-1. Casa Del Alfarero Asemblea De	R-6. Calverton Baptist Church	X-1. Montgomery County Department of Police
C-2. Calverton Swim Club	E-2. Galway Elementary School	R-2. Reid Temple AME Church	R-7. St Gregorios Indian Orthodox Church	
C-3. Briggs Chaney Park and Ride	E-3. Glenallen Elementary School	R-3. General Conference of Seventh-Day Adventists	R-8. Nations United Baptist Church	
C-4. Eastern Montgomery Regional Center		R-4. Forcey Bible Church and Christian School	R-9. Allen Chapel AME Church	
		R-5. Southern Asian Seventh Day Adventist Church	R-10. Korean Religious Facility	

US Route 29 Bus Rapid Transit (BRT)

Figure 5-6
Project Overview

Montgomery County RAPID TRANSIT US 29

Vicinity Map



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DoIT, MD iMAP, MDP

Legend

- Study Corridor
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- Floodplain
- Parks (Park)
- Observed Wetland
- Observed Stream
- Specimen Tree

1 inch = 1,000 feet

0 500 1,000 2,000 Feet

Maryland Department of Transportation MDOT

Community Facilities	Educational Facilities	Religious Facilities	Religious Facilities Continued	Religious Facilities Continued
C-1. East County Community Center	E-1. Greencastle Elementary School	R-1. Islamic Society of the Washington Area	R-7. Charis Worship Center Ministries	R-13. Montgomery Chinese Christian Church
C-2. Greencastle Park and Ride	E-2. Fairland Elementary School	R-2. Epiphany Lutheran Church	R-8. Ministerio Puerta de Paz	R-14. Redemption Community Church
C-3. Marilyn J. Praisner Comm Recreation Center	E-3. Paint Branch High School	R-3. Resurrection Catholic Church	R-9. Abundant Grace Church	**Emergency Facilities**
C-4. Marilyn J. Praisner Library	E-4. Benjamin Banneker Middle School	R-4. Renassaince Baptist Church	R-10. True Holiness Church of Jesus Christ	X-1. Burtonsville Volunteer Fire Department
C-5. Idara-e-Jaferia Comm Center	E-5. Burtonsville Elementary School	R-5. Burtonsville Baptist Church	R-11. Christ Apostolic Church	
C-6. USPS Burtonsville	E-6. Providence Christian School	R-6. Liberty Grove United Methodist Church	R-12. New Hope Korean Church	

5.3 Environmental Justice

Executive Order 12898 directs federal agencies to identify and address any disproportionately high and adverse human health or environmental effects on minority and low-income populations. The Environmental Justice considerations in proximity of the project corridor were assessed in compliance with the *Environmental Justice Guidelines for Maryland State Highway Administration Projects* (2001).

U.S. Census data (2010) was used in determining potential minority or low-income populations (see **Table 5-3**). Consistent with SHA's guidelines, minority populations are identified as Block Groups with a meaningfully greater percentage of minorities than that of a greater geographic region. For this planning study, Block Groups with minority populations greater than or equal to that of Montgomery County are considered potential environmental justice populations. Minority populations will include persons who identify themselves as Black or African-American, Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, Other, Two or More Races, or any person of Hispanic descent. Likewise, low-income populations will include Block Groups with meaningfully greater percentage of persons living below the federal poverty level than that of a greater geographic region. For this planning study, Block Groups with the percentage of persons living below poverty greater than or equal to that of Montgomery County are considered potential environmental justice populations.

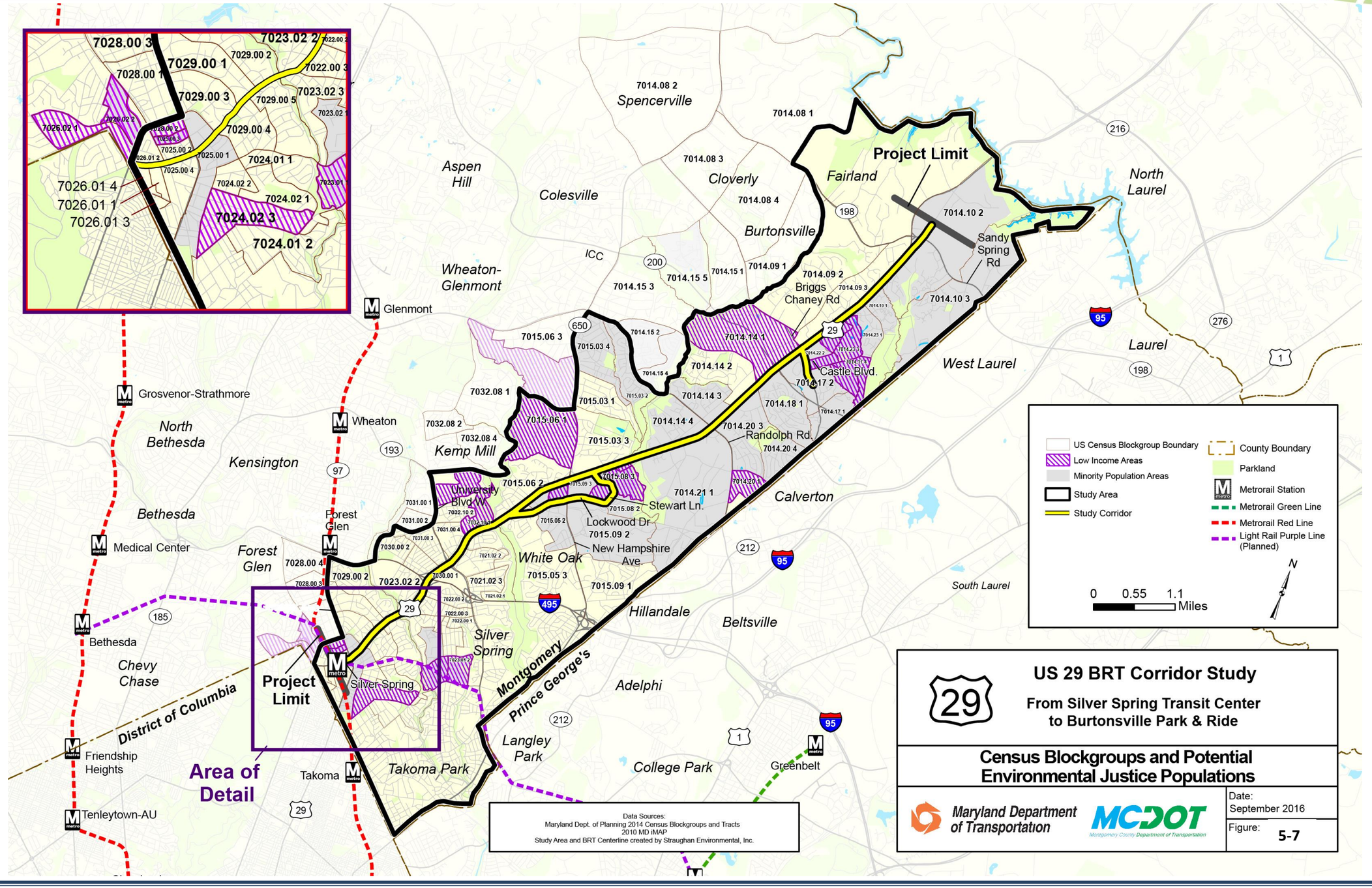
Based on the 100 percent count data from the 2010 U.S. Census, 48 of the 99 Block Groups within the project vicinity are potential minority populations. Based on the 2009-2013 U.S. Census American Community Survey Estimates, 19 of the 99 Block Groups are potentially low-income populations (see **Figure 5-7**). The Block Groups with potential minority populations are concentrated immediately along either side of US 29 north of MD 650, as well as the southern portion of the Study Area near downtown Silver Spring. The Block Groups with potential low-income populations are dispersed throughout the Study Area with the only concentration just northeast of the US 29 and MD 200 (Intercounty Connector) interchange.

Table 5-3: Potential Environmental Justice Populations

Geography		Minority (%)	EJ	Below Poverty (%)	EJ	Geography		Minority (%)	EJ	Below Poverty (%)	EJ
Study Area		62%	--	5%	--	Census Tract 7021.02	Block Group 1	32%	NO	3%	NO
Census Tract 7014.08	Block Group 1	41%	NO	0%	NO		Block Group 2	19%	NO	0%	NO
	Block Group 2	66%	YES	3%	NO		Block Group 3	16%	NO	0%	NO
	Block Group 3	42%	NO	7%	NO	Census Tract 7022	Block Group 1	65%	YES	2%	NO
	Block Group 4	44%	NO	0%	NO		Block Group 2	20%	NO	0%	NO
Census Tract 7014.09	Block Group 1	36%	NO	0%	NO		Block Group 3	28%	NO	0%	NO
	Block Group 2	62%	YES	0%	NO		Block Group 4	28%	NO	0%	NO
	Block Group 3	51%	NO	0%	NO	Census Tract 7023.01	Block Group 1	71%	YES	19%	YES
Census Tract 7014.10	Block Group 1	87%	YES	3%	NO		Block Group 2	87%	YES	11%	YES
	Block Group 2	79%	YES	6%	NO	Census Tract 7023.02	Block Group 1	67%	YES	2%	NO
	Block Group 3	78%	YES	0%	NO		Block Group 2	25%	NO	0%	NO
Census Tract 7014.14	Block Group 1	63%	YES	10%	YES		Block Group 3	62%	YES	2%	NO
	Block Group 2	64%	YES	7%	NO	Census Tract 7024.01	Block Group 1	31%	NO	7%	NO
	Block Group 3	76%	YES	6%	NO		Block Group 2	43%	NO	2%	NO
	Block Group 4	87%	YES	3%	NO	Census Tract 7024.02	Block Group 1	62%	YES	0%	NO
Census Tract 7014.15	Block Group 1	46%	NO	0%	NO		Block Group 2	52%	NO	0%	NO
	Block Group 2	81%	YES	0%	NO		Block Group 3	64%	YES	19%	YES
	Block Group 3	53%	NO	0%	NO	Census Tract 7025	Block Group 1	75%	YES	5%	NO
	Block Group 4	69%	YES	1%	NO		Block Group 2	61%	NO	0%	NO
	Block Group 5	84%	YES	3%	NO		Block Group 3	69%	YES	41%	YES
Census Tract 7014.17	Block Group 1	83%	YES	7%	NO		Block Group 4	59%	NO	7%	NO
	Block Group 2	76%	YES	7%	NO	Census Tract 7026.01	Block Group 1	65%	YES	0%	NO
	Block Group 3	78%	YES	9%	YES		Block Group 2	50%	NO	0%	NO
	Block Group 4	85%	YES	20%	YES		Block Group 3	55%	NO	0%	NO
Census Tract 7014.18	Block Group 1	78%	YES	2%	NO		Block Group 4	51%	NO	0%	NO
Census Tract 7014.20	Block Group 1	35%	NO	9%	YES	Census Tract 7026.02	Block Group 1	39%	NO	12%	YES
	Block Group 2	8%	NO	0%	NO		Block Group 2	64%	YES	16%	YES
	Block Group 3	74%	YES	0%	NO	Census Tract 7028	Block Group 1	37%	NO	2%	NO
	Block Group 4	70%	YES	7%	NO		Block Group 2	61%	NO	11%	YES
Census Tract 7014.21	Block Group 1	88%	YES	3%	NO		Block Group 3	30%	NO	0%	NO
Census	Block Group 1	95%	YES	35%	YES		Block Group 4	38%	NO	6%	NO

Table 5-3: Potential Environmental Justice Populations, Continued

Geography		Minority (%)	EJ	Below Poverty (%)	EJ
Tract 7014.22	Block Group 2	97%	YES	4%	NO
Census Tract 7014.23	Block Group 1	75%	YES	0%	NO
	Block Group 2	93%	YES	13%	YES
	Block Group 3	91%	YES	12%	YES
Census Tract 7015.03	Block Group 1	63%	YES	0%	NO
	Block Group 2	73%	YES	4%	NO
	Block Group 3	63%	YES	0%	NO
	Block Group 4	68%	YES	3%	NO
Census Tract 7015.05	Block Group 1	80%	YES	20%	YES
	Block Group 2	73%	YES	0%	NO
	Block Group 3	60%	NO	5%	NO
Census Tract 7015.06	Block Group 1	42%	NO	8%	NO
	Block Group 2	59%	NO	4%	NO
	Block Group 3	47%	NO	0%	NO
Census Tract 7015.08	Block Group 1	92%	YES	31%	YES
	Block Group 2	84%	YES	0%	NO
	Block Group 3	90%	YES	12%	YES
Census Tract 7015.09	Block Group 1	52%	NO	0%	NO
	Block Group 2	93%	YES	6%	NO
	Block Group 3	91%	YES	3%	NO
	Block Group 4	96%	YES	19%	YES
Census Tract 7029	Block Group 1	20%	NO	0%	NO
	Block Group 2	31%	NO	0%	NO
	Block Group 3	36%	NO	0%	NO
	Block Group 4	45%	NO	0%	NO
	Block Group 5	18%	NO	0%	NO
Census Tract 7030	Block Group 1	39%	NO	0%	NO
	Block Group 2	32%	NO	2%	NO
Census Tract 7031	Block Group 1	64%	YES	4%	NO
	Block Group 2	47%	NO	0%	NO
	Block Group 3	46%	NO	4%	NO
	Block Group 4	47%	NO	0%	NO
Census Tract 7032.08	Block Group 1	20%	NO	0%	NO
	Block Group 2	14%	NO	0%	NO
	Block Group 3	47%	NO	5%	NO
	Block Group 4	48%	NO	2%	NO
Census Tract 7032.10	Block Group 1	61%	NO	10%	YES
	Block Group 2	55%	NO	3%	NO



US 29 BRT Corridor Study

From Silver Spring Transit Center to Burtonsville Park & Ride

Census Blockgroups and Potential Environmental Justice Populations

Maryland Department of Transportation MCDOT

Date: September 2016

Figure: 5-7

5.4 Indirect and Cumulative Effects Analysis

Once more detailed engineering has been conducted on the proposed alternatives as part of subsequent phases of study, a detailed Indirect and Cumulative Effects (ICE) scoping and analysis will be completed according to guidance provided by the Maryland State Highway Administration in Section 1, "Scoping/Initial ICE Analysis Activities" in the 2007 *Indirect and Cumulative Effects Analysis Guidelines*. Indirect effects are defined as, "Effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR § 1508.8(b)). Cumulative effects are defined as, "Impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR § 1508.7).

This pre-scoping consideration of indirect and cumulative effects will evaluate socioeconomic, cultural, and environmental resources of concern; the geographical and temporal boundaries to be included during future stages of the US 29 BRT Study; and the past, present, and reasonably foreseeable future development actions. Proposed improvements associated with the US 29 BRT project would affect capacity along the US 29 corridor, which could encourage development within the Study Area.

The environmental resources of concern for an indirect and cumulative effects analysis are typically the environmental resources that would be directly affected by the project. The proposed US 29 BRT project would predominately occur on existing roadway and other paved surfaces, and there would be limited direct environmental effects on natural resources. However, potential direct effects of the proposed project are listed below. These resources must be considered in the indirect and cumulative effects analysis:

- Right-of-way acquisition
- Business or residential displacement
- Effects to access or mobility for residents and businesses in the corridor vicinity
- Effects to community facilities
- Historic Properties
- Parks
- Forested Areas
- Waters of the US and Wetland

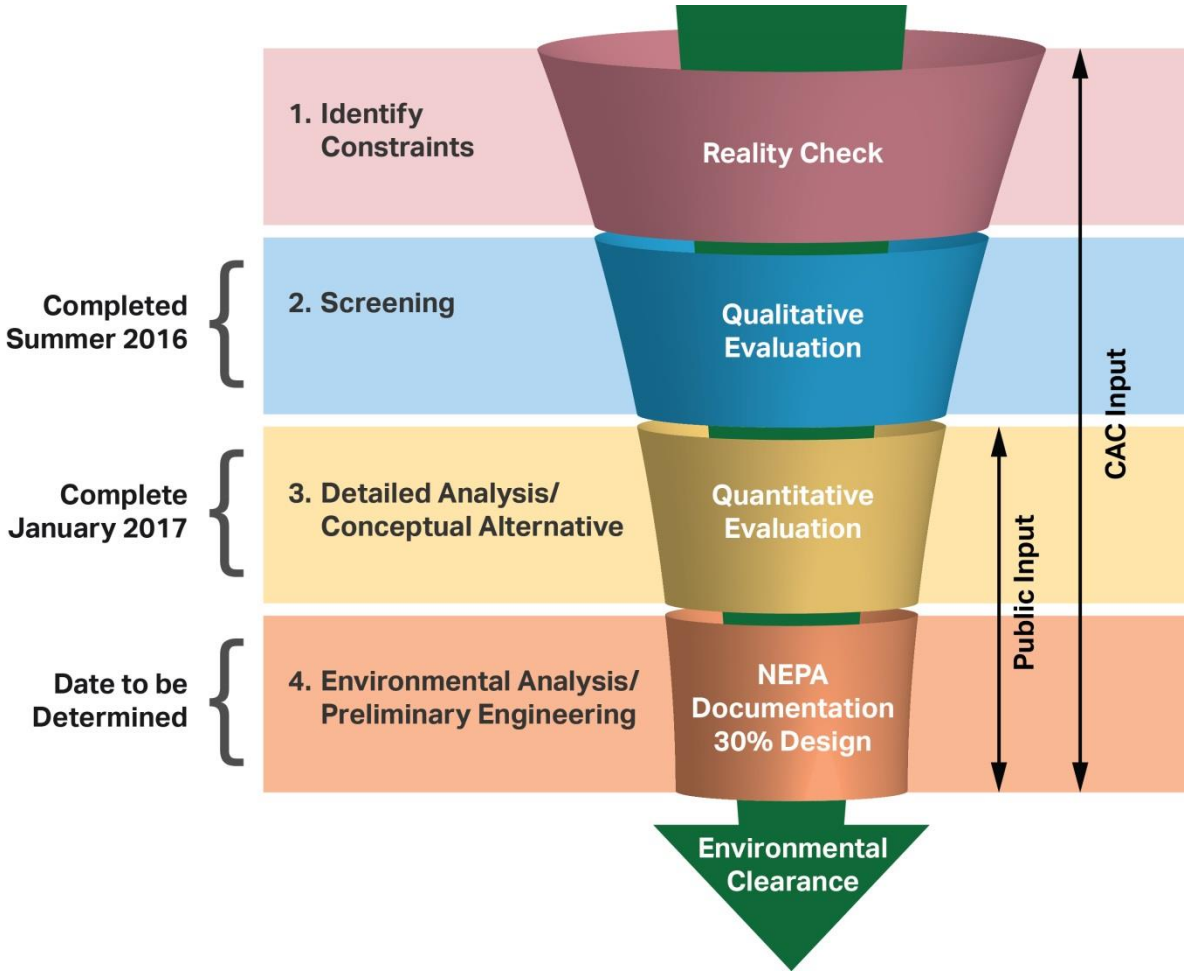
6 Alternative Evaluation

As discussed in Chapter 4, the conceptual alternatives were evaluated using two sets of criteria – an initial qualitative evaluation followed by a more detailed quantitative evaluation. The following chapter provides a summary of the qualitative and quantitative alternative evaluation process and results.

6.1 Evaluation Process

Figure 6-1 provides an overview of the overall evaluation process for this study. There are four main steps: Identify Constraints, Screening, Detailed Analysis/Conceptual Alternative, and Environmental Analysis/Preliminary Engineering. Each of these steps receives review and input from project stakeholders, including Study Team members from MDOT, MCDOT, and Corridor Advisory Committee members.

Figure 6-1: Evaluation Process Flow Chart



6.2 Level One: Identify Constraints (Reality Check)

The intent of level one is to quickly and efficiently utilize qualitative evaluation criteria to gauge the ability of each preliminary conceptual alternative to meet the project purpose. Any fatally-flawed alternative, that is any alternative that could not feasibly meet the project purpose, is eliminated from further evaluation at this stage. For example, Alternative 7 looked at possible roadway widening in sections south of I-495 where extensive right-of-way impacts and related acquisition would be required. Because the purpose of this project includes the avoidance of right-of-way impacts as a key metric[7], this preliminary conceptual alternative was quickly eliminated from further consideration. Similarly, other preliminary conceptual alternatives, like Alternatives 4 and 8 were eliminated from further consideration because the Study Team determined that they would not best meet the project purpose due to potential impacts to properties, natural resources, traffic operations and safety, and/or constructability concerns. Other factors considered included construction duration, costs, and complexity.

6.3 Level Two: Screening (Qualitative Evaluation)

Several preliminary conceptual alternatives passed the initial round of qualitative evaluation screening for fatal flaws. These preliminary conceptual alternatives, namely Alternatives 2, 3, 5 and 6, were sketched out to take a slightly more detailed, but still qualitative, look at the level of impact and functional benefit they might achieve if implemented. A specific example is with Alternative 3, where the Study Team investigated opportunities to repurpose existing median areas and left turn lanes to provide a peak direction reversible BRT lane. Ultimately, the team determined that this alternative would likely require roadway widening at selected locations, and meeting the purpose of this project would introduce an unacceptable level of right-of-way impacts and traffic operations issues. Alternative 3 was eliminated from consideration due to qualitative concerns about traffic operations, safety, and potential right-of-way impacts. Alternative 5 was similarly eliminated during this phase. Features of Alternative 2 were incorporated in to the retained Alternatives A, B, and B Modified. As discussed previously in Chapter 4, the following preliminary conceptual alternatives were eliminated from consideration:

- Alternative 3 Median BRT Lanes (Median and Left Turn Lane Repurposing) - Eliminated
- Alternative 4 Curb Business Access Transit (BAT) Lanes (Reversible Lane Repurposing and Widening) - Eliminated
- Alternative 5 Median BRT Lanes (Median Repurposing and Widening) - Eliminated

[7] In early spring 2016, the Montgomery County Executive announced that the alternative implemented in the US 29 corridor had to be built within the existing right-of-way to the extent possible to avoid significant property impacts and should be implemented in fewer than four years.

- Alternative 7 Additional BRT Lanes (Widening) - Eliminated
- Alternative 8 Additional Curb BAT Lanes (Widening) - Eliminated

6.4 Level Three: Detailed Analysis (Quantitative Evaluation)

Once the first two rounds of evaluation had been completed, the Study Team had retained three conceptual build alternatives: No-build, Alternative A, and Alternative B. As the initial model results became available, the Study Team elected to test a new alternative, Alternative B Modified, which incorporates the northern end median shoulder treatment into Alternative B.

The following sub-sections describe the quantitative evaluation screening criteria that the Study Team has compiled for the analysis and comparison of the No-Build and three remaining conceptual build alternatives (Alternative A, Alternative B, and Alternative B Modified). This section summarizes the methodologies and evaluation analyses used to generate forecasted ridership, travel demand and traffic operations, costs, and environmental impacts associated with the proposed conceptual build alternatives.

6.4.1 Ridership Forecasting and Forecasted 2040 Traffic Operations

Ridership forecasting and forecasted 2040 Traffic Operations, important elements of the US 29 BRT Study, were conducted using MWCOG and the National Capital Regional TPB Travel Demand Forecasting Model Version 2.3.57 as the base model, with refinements and validation in the study area.

6.4.1.1 *Ridership Forecasts*

The following is a summary of the ridership forecasting methodology used to generate anticipated transit boardings along US 29.

6.4.1.1.1 Model Assumptions and Methodology

The base model set for this study was the TPB/MWCOG regional travel model Version 2.3.57, with model validation for the base year 2014, for the US 29 corridor and 2040 No-Build, refined and prepared by MWCOG in April 2015.

For the purposes of this study, the TPB/MWCOG model set was enhanced to include the following assumptions and refinements, which were previously adopted and discussed in the original project Purpose and Need analysis:

- Land Use is the MWCOG Cooperative Forecast Round 8.3, with modifications using the White Oak area socio-economic forecasts from the M-NCPPC.
- Network is the CLRP 2014 adopted on October 15, 2014 with refinements by MWCOG and Cambridge Systematics to better reflect transportation facility details along the US 29 corridor.

- MWCOG modification is focused on ensuring that roadway and transit networks are up-to-date (including headway and routing) and that centroid connections were correct.

MWCOG conducted the initial model validation, including both highway and transit. After further model refinements were made, the transit ridership estimates from the base year model were compared and verified against the observed transit ridership.

The ridership forecasting process also included FTA recommended performance credit adjustments to account for the effects of premium guideway enhancements as part of the analysis.

6.4.1.1.2 Ridership Forecast for 2040 No-Build Alternative

This section presents ridership forecasting results for the No-Build scenario for the purposes of comparison with the Build alternatives. **Tables 6-1 and 6-2** highlight the modeling assumptions of the corridor bus routes, such as frequency of the corridor routes in the peak and off-peak periods, run time, total route distance, and speed.

Table 6-1: 2040 No-Build Characteristics of the Metrobus Corridor Routes

Route Name/Direction	Headway (min)		Run Time (min)	Total Route Distance (miles)	Average Speed (mph)
	PK	OP			
WMATA Z2 Inbound	10	60	65	16	15
WMATA Z2 Outbound	30	60	60	18	18
WMATA Z6 (Briggs Chaney Rd)	60		54	10	11
WMATA Z6 (Burtonsville)	10,60	30	65	13	12
WMATA Z8 Inbound (Briggs Chaney Rd)	60		44	9	12
WMATA Z8 (Greencastle Rd)	10,60	30	57	12	12
WMATA Z9	10		39	10	16
WMATA Z29	10		59	18	19
WMATA Z11	9		54	10	11
WMATA Z13	10		30	10	20

*PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period
** Route Z6 has two run patterns in inbound direction: starting from Burtonsville and starting from Castle Blvd

Table 6-2: 2040 No-Build Characteristics of the Local Corridor Bus Routes

Route Name/Direction	Headway (min)		Run Time (min)	Total Route Distance (miles)	Average Speed (mph)
	PK	OP			
Ride On 8 Inbound	30	30	47	8	10
Ride On 8 Outbound	30	30	49	8	10
Ride On 9 Inbound	20	30	36	6	10
Ride On 9 Outbound	25	27	36	6	10
Ride On 10 Inbound	30	30	71	14	11
Ride On 10 Outbound	30	30	76	14	11
Ride On 13 Inbound	60		32	6	11
Ride On 13 Outbound	10		32	6	11
Ride On 21 Inbound/Outbound	30		65	13	12
Ride On 22 Inbound	30		45	7	9
Ride On 22 Outbound	20		39	7	10
MTA Commuter Bus 201	60	60	142	77	32
MTA Commuter Bus 202	60		101	43	25
MTA Commuter Bus 203	30	60	96	43	27
MTA Commuter Bus 305	20	60	182	34	11
MTA Commuter Bus 315	60	60	180	39	13
MTA Commuter Bus 325	30		170	35	12

*PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period

Table 6-3 presents the summary of forecasted boardings on the corridor bus routes in the No-Build alternative. As can be seen from the table, the average weekday ridership on Z-lines is around 17,440 boardings per day, while the total study area ridership is approximately 28,530 boardings (increased from 23,830 in 2015). It should be noted that Ride On and MTA buses show a decrease in ridership from 2015 due to the attractiveness of the Z routes and service changes between 2015 and 2040.

Table 6-3: Daily Summary of 2040 Forecasted Bi-Directional Transit Boardings for 2040 No-Build

Bus Routes/Names	PK	OP	Daily Boardings
WMATA Z Buses (Z2, Z6, Z8, Z29)	14,870	2,570	17,440
Ride On Buses (8,9,10,13,21,22)	1,680	1,440	3,120
MTA Buses (201,202,203,305,315,325)	7,900	70	7,970
Total	**24,450**	**4,080**	**28,530**

*PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period **Numbers rounded to the nearest 10

6.4.1.1.3 Ridership Forecast for Alternative A

This section presents 2040 ridership forecasting results for Alternative A. For reporting purposes, certain BRT stations were grouped together. **Table 6-4** presents the station groups and corresponding stations.

Table 6-4: Station Groups and Corresponding BRT Stations

Station Group	Stations
Silver Spring Transit Center	Silver Spring Transit Center
Fenton Street	Fenton Street
University Boulevard	University Boulevard
Burnt Mills/Lockwood Drive	Burnt Mill Shopping Center Oak Leaf Drive White Oak Transit Center
Stewart Lane and April Lane	Stewart Lane and April Lane
Tech Road	Tech Road
Briggs Chaney Road and Park and Ride	Briggs Chaney Road Briggs Chaney Park and Ride
Castle Boulevard	Castle Blvd and Castle Terrace Castle Blvd and Woodlake Drive
Burtonsville Park and Ride	Burtonsville Park and Ride

As seen from the **Table 6-5**, the total BRT ridership in the forecast year is approximately 18,120 boardings, with approximately 53 percent of the boardings in the peak periods and 47 percent in off-peak period. Stations with the highest boardings are Silver Spring Transit Center (29 percent of total boardings), Fenton Street (14 percent), Stewart Lane and April Lane (13 percent), and Tech Road (15 percent).

Table 6-5: 2040 Alternative A Forecasted BRT Boardings by Time of Day

Station/Station Group	PK	OP	Daily Boardings
Silver Spring Transit Center	3,240	2,050	5,290
Fenton Street	910	1,690	2,600
University Boulevard	260	840	1,100
Burnt Mills/Lockwood Drive	220	880	1,100
Stewart Lane and April Lane	1,130	1,290	2,420
Tech Road	1,590	1,110	2,700
Briggs Chaney Road and Park and Ride	450	480	930
Castle Boulevard	690	0	690
Burtonsville Park and Ride	1,110	180	1,290
Total	**9,600**	**8,520**	**18,120**

* PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period. **Numbers rounded to the nearest 10.

Table 6-6 presents the summary of boardings on the BRT line as well as on the corridor bus routes as a result of the implementation of Alternative A. As can be seen from the table, the daily ridership was estimated to be 6,400 on Z-lines, 2,220 on Ride On buses, and 8,150 boardings on MTA buses, with the total study area ridership summing up to 34,890, which is an increase of 6,300 boardings from the No-Build. The ridership would increase by two percent in the peak periods and by 147 percent in the off-peak period in comparison to the No-Build.

Table 6-6: 2040 Alternative A Forecasted Daily Transit Boardings

BRT/Bus Route	PK	OP	Daily Boardings
Alternative A BRT	9,600	8,520	18,120
WMATA Z Buses (Z2, Z6, Z8, Z29)	5,880	520	6,400
Ride On Buses (8,9,10,13,21,22)	1,270	950	2,220
MTA Buses (201,202,203,305,315,325)	8,080	70	8,150
Total	**24,830**	**10,060**	**34,890**

* PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period
** Boarding numbers have been rounded to the nearest 10

In comparison with the No-Build scenario, there is an increase of 4,530 daily linked transit trips for Alternative A (see **Table 6-12**), including those from/to and within the corridor. Home-based work (HBW) transit trips for Alternative A constitute the highest share of transit trips with approximately 71 percent of regional transit trips. There are approximately 17 percent of home-based other (HBO) trips and relatively a small share of non-home based (NHB), home-based school (HBS) and non-home based other (NHO) trips. Within the study area, White Oak and Silver Spring districts produce and attract the highest number of transit riders on the BRT in comparison to other districts.

Transit trips are different from boardings in that they are linked trips defined by the origin and destination and trip purpose, while boardings represent the number of times riders board the transit vehicle. A linked transit trip can have more than one boarding.

6.4.1.1.4 Ridership Forecast for Alternative B

This section presents 2040 ridership forecasting results for Alternative B. **Table 6-7** presents boardings by station and station groups on US 29 for Alternative B. As seen from the table, the total BRT ridership in the forecast year is approximately 16,430 boardings, with approximately 51 percent of the boardings in the peak periods and 49 percent in off-peak period. Stations with

the highest boardings are Silver Spring Transit Center (34 percent of total boardings), Fenton Street (12 percent) and Stewart Lane and April Lane (14 percent) and Tech Road (15 percent).

Table 6-7: 2040 Alternative B Forecasted BRT Boardings by Time of Day

Station/Station Group	PK	OP	Daily Boardings
Silver Spring Transit Center	3,180	2,330	5,510
Fenton Street	500	1,420	1,920
University Boulevard	240	840	1,080
Burnt Mills/Lockwood Drive	280	870	1,150
Stewart Lane and April Lane	1,050	1,230	2,280
Tech Road	1,520	1,080	2,600
Briggs Chaney Road Park and Ride	90	0	90
Castle Boulevard	700	0	700
Burtonsville P&R	830	270	1,100
Total	**8,390**	**8,040**	**16,430**

* PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period
** Boarding numbers have been rounded to the nearest 10

Table 6-8 presents the summary of boardings for Alternative B as well as on the corridor bus routes as a result of the implementation of the build alternative. As can be seen from the table, the daily ridership was estimated to be 6,740 on Z-lines, 2,300 on Ride On buses, and 8,200 boardings on MTA buses, the sum of the total study area ridership being 33,670, which is an increase of 5,140 boardings from the No-Build. The ridership will decrease by two percent in the peak periods and increased by 140 percent in the off-peak period in comparison to the No-Build.

Table 6-8: 2040 Alternative B Forecasted Daily Transit Boardings

BRT/Bus Route	PK	OP	Daily Boardings
Alternative B BRT	8,390	8,040	16,430
WMATA Z Buses (Z2, Z6, Z8, Z29)	6,040	700	6,740
Ride On Buses (8,9,10,13,21,22)	1,320	980	2,300
MTA Buses (201,202,203,305,315,325)	8,130	70	8,200
Total	**23,880**	**9,790**	**33,670**

* PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period
** Boarding numbers have been rounded to the nearest 10

There is an overall increase of approximately 3,580 transit trips for Alternative B (see **Table 6-12**). Regional HBW transit trips for Alternative B constitute the highest share of transit trips, with approximately 71 percent of regional transit trips. There are approximately 17 percent of HBO trips and a relatively small share of NHB, HBS and NHO trips. Within the study area, White Oak and Silver Spring districts produce and attract the highest number of transit riders on the BRT when compared to other districts.

To properly assign traffic volumes in the VISSIM model for the managed lanes in Alternative B and Alternative B Modified, it was necessary to determine what vehicles that qualify as HOV 2+ would use these lanes between Timberwood Avenue and Prelude Drive north of the Beltway, and between Sligo Creek Parkway and Fenton Street south of I-495. This was done by reviewing the peak period volumes assigned to the peak period/direction HOV 2+ lanes coded into the 2040 MWCOG model network along US 29 for Alternatives B and B Modified.

When compared to the overall 2040 No-Build peak hour volumes on US 29, the 1,300 and 900 peak hour HOV 2+ volumes account for over 35% of total volume in the peak direction between Timberwood and Prelude, and over 25% between Sligo Creek and Fenton. As the MWCOG model does not account for friction from stopped busses and right-turning traffic in the managed lanes, it was the opinion of the forecasting team that the assignment of peak period/direction traffic to the HOV lanes exceeding 25% of total traffic volumes in all lanes would be too aggressive. It was also noted that recent vehicle occupancy counts taken for Montgomery County DOT along the corridor showed that in 2015 that only 15% of passenger vehicles were found to be HOV 2+ eligible, generally matching the 2015 model results.

Based on vehicle occupancy counts, it was decided that the appropriate percentage to use for HOV 2+ vehicles to total vehicles was 25 percent in the managed lanes for Alternatives B and B Modified. This results in volumes in the range of 500 to 1050 peak hour HOV 2+ vehicles on the managed lanes in this corridor.

When comparing the total peak hour/direction HOV 2+ volumes for all lanes of traffic forecast to be on US 29 in 2040 between the No-Build Alternative and Alternative B and B Modified, the HOV 2+ volumes are forecasted to increase by over 60 percent in the AM and PM peaks when compared to the No-Build.

6.4.1.1.5 Ridership Forecast for Alternative B Modified

This section presents 2040 ridership forecasting results for Alternative B Modified. **Table 6-9** presents boardings by station and station groups on US 29 for Alternative B Modified. As seen from the table, the total ridership in the forecast year is approximately 17,310 boardings, with approximately 52 percent of the boardings in the peak periods and 48 percent in off-peak

period. Stations with the highest boardings are Silver Spring Transit Center (34 percent of total boardings), Fenton Street (12 percent) and Stewart Lane and April Lane (13 percent) and Tech Road (16 percent).

Table 6-9: 2040 Alternative B Modified Forecasted BRT Boardings by Time of Day

Station/Station Group	PK	OP	Daily Boardings
Silver Spring Transit Center	3,480	2,390	5,870
Fenton Street	530	1,460	1,990
University Boulevard	250	860	1,110
Burnt Mills/Lockwood Drive	300	880	1,180
Stewart Lane and April Lane	1,050	1,250	2,300
Tech Road	1,630	1,110	2,740
Briggs Chaney Road Park and Ride	80	0	80
Castle Boulevard	690	0	690
Burtonsville Park and Ride	1,060	290	1,350
Total	**9,070**	**8,240**	**17,310**

* PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period
** Boarding numbers have been rounded to the nearest 10

Table 6-10 presents the summary of boardings for Alternative B Modified as well as on the corridor bus routes as a result of the implementation of the build alternative. As can be seen from the table, the daily ridership was estimated to be 6,530 on Z-lines, 2,370 on Ride On buses, and 8,180 boardings on MTA buses, the sum of the total study area ridership being 34,390, which is an increase of 5,860 boardings from the No-Build. The ridership would not change in the peak periods and increase by 144 percent in the off-peak period in comparison to the No-Build.

Table 6-10: 2040 Alternative B Modified Forecasted Daily Transit Boardings

BRT/Bus Route	PK	OP	Daily Boardings
Alternative B Modified BRT	9,070	8,240	17,310
WMATA Z Buses (Z2, Z6, Z8, Z29)	5,860	670	6,530
Ride On Buses (8,9,10,13,21,22)	1,390	980	2,370
MTA Buses (201,202,203,305,315,325)	8,120	60	8,180
Total	**24,440**	**9,950**	**34,390**

* PK = Peak Periods (6 am – 9 am and 3 pm – 7 pm), OP = Off-Peak Period ** Boarding numbers rounded to the nearest 10

There is an overall increase of approximately 3,600 transit trips for Alternative B Modified (see **Table 6-12** below). Regional HBW transit trips for Alternative B Modified constitute the highest share of transit trips, with approximately 71 percent of regional transit trips. There are approximately 17 percent of HBO trips and a relatively small share of NHB, HBS and NHO trips. Within the study area, the White Oak and Silver Spring districts produce and attract the highest number of transit riders on the BRT when compared to other districts.

6.4.1.1.6 Summary of Ridership Forecasts

Table 6-11 summarizes the ridership forecasts for the No-Build when compared with Alternatives A, B, and B Modified. As can be seen in the table, Alternative A results in 22 percent increase in total corridor ridership in comparison to No-Build scenario, and similarly, forecasts show 18 percent increase in ridership for Alternative B and 20 percent increase in ridership for Alternative B Modified. Alternative A attracts more BRT and total transit riders in comparison to Alternatives B and B Modified.

Table 6-11: Summary of 2040 Forecasted Boardings on BRT and other Corridor Routes by Alternative

Bus Routes/Names	Daily Boardings			
	No-Build	Alternative A	Alternative B	Alternative B Modified
BRT	0	18,120	16,430	17,310
WMATA Z Buses (Z2, Z6, Z8, Z29)	17,440	6,400	6,740	6,530
Ride On Buses (8,9,10,13,21,22)	3,120	2,220	2,300	2,370
MTA Buses (201,202,203,305,315,325)	7,970	8,150	8,200	8,180
Total	**28,530**	**34,890**	**33,670**	**34,390**

* Boarding numbers have been rounded to the nearest 10

Table 6-12 summarizes regional transit trips by trip purpose for the No-Build scenario and Alternatives A, B, and B Modified. As can be seen in the table, Alternative A results in a 4,530 transit trips increase from the No-Build scenario, and similarly, forecasts show a 3,580 transit trips increase for Alternative B and a 3,600 transit trips increase for Alternative B Modified.

Table 6-12: Summary of 2040 Regional Transit Trips by Trip Purpose and Alternative

Trip Purpose	No-Build	Alternative A	Alternative B	Alternative B Modified
HBW	1,118,230	1,118,590	1,118,210	1,118,170
HBO	270,840	272,870	272,680	272,710
NHB	124,210	125,400	125,140	125,140
HBS	21,800	22,030	22,000	22,000
NHO	40,610	41,330	41,240	41,270
Total	**1,575,690**	**1,580,220**	**1,579,270**	**1,579,290**

Home-based work (HBW), Home-based other (HBO), Non-home based (NHB), Home-based school (HBS), Non-Home based other (NHO)
* Numbers have been rounded to the nearest 10

Table 6-13 presents a summary of changes in auto vehicle miles traveled (VMT) and transit person miles traveled (PMT) for Alternatives A, B, and B Modified, in comparison to the No-Build. Transit PMT measure indicates the magnitude of total transit travel as a result of implementing the alternatives. As seen from the tables, all build alternatives would reduce auto VMT but increase transit PMT relative to the No-Build, which is an indication of the project's effectiveness in promoting transit when compared to auto.

Table 6-13: Summary of Regional Daily Changes in VMT and PMT in Comparison to No-Build

Measure	No-Build	Alternative A	Alternative B	Alternative B Modified
Auto VMT (miles)	4,376,860	4,373,640	4,366,750	4,367,180
Transit PMT (miles)	234,070	268,870	260,370	253,240
Changes in Auto VMT versus No-Build		-3,220	-10,110	-9,680
Changes in Transit PMT versus No-Build		34,800	26,300	19,170

* Numbers have been rounded to the nearest 10

Transit accessibility was estimated in terms of population and employment reachable within 45 minutes and 60 minutes via transit to and from the study area as a result of implementing Alternatives A, B, and B Modified.

Table 6-14 presents a summary of accessibility changes in terms of population and employment accessible within 45 minutes and 60 minutes via transit to and from the study area as a result of implementing Alternatives A, B, and B Modified. As can be seen from the table, all alternatives would increase accessibility, relative to the No-Build.

Table 6-14: Summary of Forecasted 2040 Accessibility Changes by Alternative

Measure	No-Build	Alternative A	Alternative B	Alternative B Modified
Population within 45 min by transit	439,000	459,800	456,800	456,000
Population within 60 min by transit	964,400	966,700	965,300	964,400
Employment within 45 min by transit	543,300	555,200	553,500	555,700
Employment within 60 min by transit	1,160,500	1,167,400	1,164,700	1,160,500
Population change versus No-Build within 45 min		20,800	17,800	17,000
Population change versus No-Build within 60 min		2,300	900	0
Employment change versus No-Build within 45 min		11,900	10,200	10,400
Employment change versus No-Build within 60 min		6,900	4,200	0

* Numbers have been rounded to the nearest 10

Based on the max load analysis, in Alternative A each route pattern would have to run every eight minutes (combined headway of four minutes) and in Alternative B, each pattern would have to run every 10 minutes. The operating plan had each pattern running every 12 minutes. These conclusions should be revisited as these alternatives are further developed.

6.4.1.2 *Forecasted 2040 Traffic Operations*

The following sections describe the travel demand analysis and forecasted future traffic operations associated with the 2040 No-Build condition and proposed conceptual build alternatives.

6.4.1.2.1 Existing Conditions Model Calibration

SHA provided previously calibrated VISSIM models for the downtown Silver Spring area (from US 29 at MD 97 to Sligo Creek Parkway) and US 29 at I-495. Using these as a base, VISSIM models were further developed for the BRT project's expanded study area to model and simulate the typical weekday AM and PM peak hours under existing conditions. The VISSIM study network is shown in **Figure 6-2**. Additionally, *Synchro* models were obtained and further developed for signal timing optimization purposes and for the purposes of identifying initial ridership modeling assumptions.

Existing 2015 peak hour VISSIM models for 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM were calibrated to match balanced intersection turning movement counts and link volume data within the study area. The VISSIM model was also calibrated to match existing field-confirmed travel times and meet the validation targets of an overall 10 percent difference along the entire corridor and +/- 30 seconds along the smaller travel time segments through links between intersections. The following input sources were used to help develop and refine the VISSIM Model:

- Operational Patterns
- Background Bus Network Changes
- Pedestrian Volumes
- Local Bus Ridership and Dwell Time
- Transit Signal Priority
- Assumed Future Development and Infrastructure Projects in the CLRP

Table 6-15 provides a summary of the assumptions used for the Synchro and VISSIM modeling efforts of the 2040 No-Build Alternative, Alternative A, Alternative B, and Alternative B Modified.

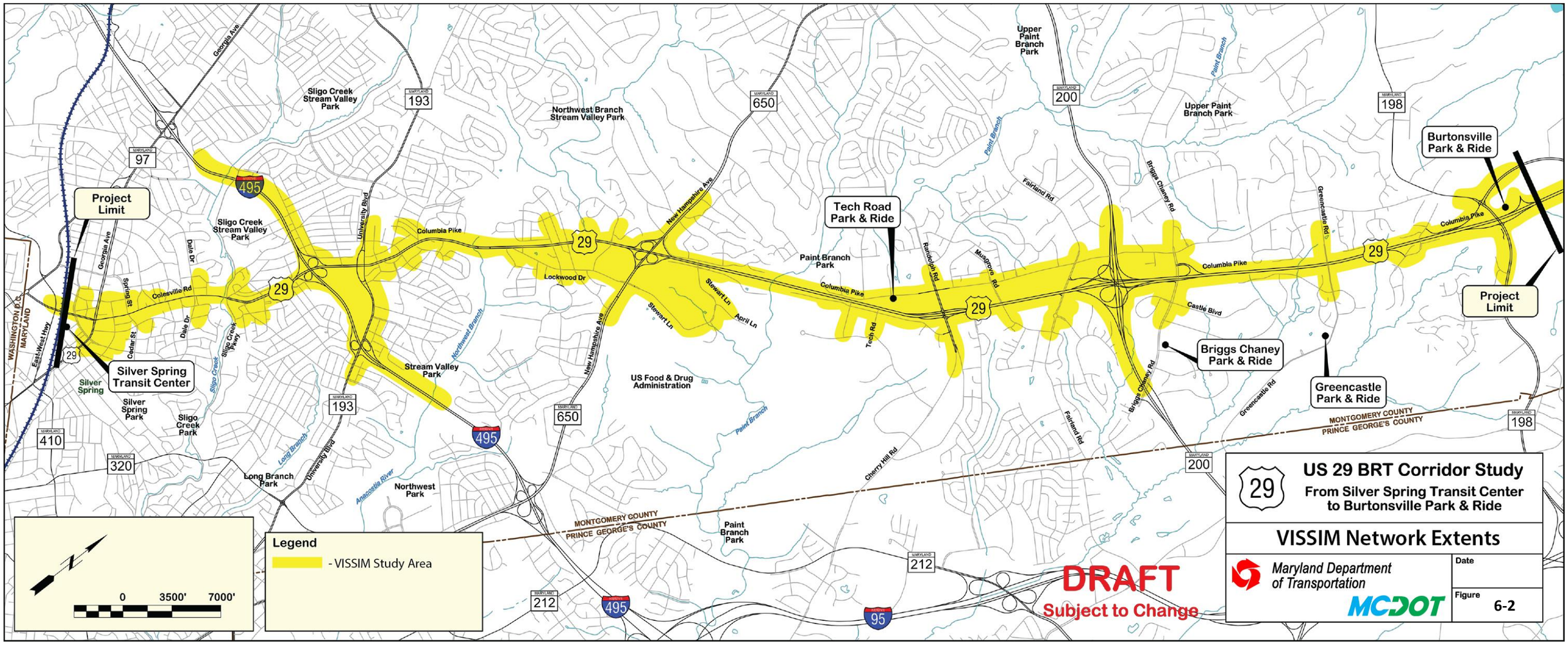

Project Limit
Silver Spring Transit Center
Tech Road Park & Ride
Burtonsville Park & Ride
Project Limit
Briggs Chaney Park & Ride
Greencastle Park & Ride
Sligo Creek Stream Valley Park
Northwest Branch Stream Valley Park
Upper Paint Branch Park
Paint Branch Park
Stream Valley Park
US Food & Drug Administration
Silver Spring Park
Sligo Creek Park
Long Branch Park
Northwest Park
Columbia Pike
Colesville Rd
Georgia Ave
University Blvd
New Hampshire Ave
Lockwood Dr
Stewart Ln
April Ln
Randolph Rd
Tech Rd
Musgrove Rd
Fairland Rd
Briggs Chaney Rd
Greencastle Rd
Castle Blvd
Spring St
Dale Dr
Cedar St
East-West Hwy
Sligo Creek Pkwy
Northwest Branch
Paint Branch
Long Branch
Anacostia River
Cherry Hill Rd
MONTGOMERY COUNTY
PRINCE GEORGE'S COUNTY
WASHINGTON D.C.
MARYLAND
Silver Spring
MARYLAND 97
MARYLAND 193
MARYLAND 650
MARYLAND 200
MARYLAND 198
MARYLAND 410
MARYLAND 320
MARYLAND 212
29
495
95
0 3500' 7000'
Legend
- VISSIM Study Area
DRAFT
Subject to Change
US 29 BRT Corridor Study
From Silver Spring Transit Center to Burtonsville Park & Ride
VISSIM Network Extents
Maryland Department of Transportation
MCDOT
Date
Figure 6-2

Table 6-15: Summary of Synchro and VISSIM Modeling Assumptions

Assumptions	No-Build Alternative	Alternative A	Alternative B	Alternative B Modified
Proposed Changes to Operations	No improvements beyond what is already included in the region's 2040 CLRP (2014)	Traffic Signals at US 29 at MD 193: reroute left turn movements from east and west to the existing jug-handles then right on US 29.	Traffic Signals at US 29 at MD 193: reroute left turn movements from east and west to the existing jug-handles then right on US 29.	Traffic Signals at US 29 at MD 193: reroute left turn movements from east and west to the existing jug-handles then right on US 29.
Traffic Volumes	-MWCOG Regional Model -NCHRP 756 methodologies	Alternative A volumes remain the same as No-Build.*	Overall traffic volumes are assumed to decrease by up to 600 vehicles, depending upon location. Up to 25% of vehicles in managed lanes assumed to be HOV. 60% overall increase in HOV from No-Build during AM and PM Peak.	Alternative B Modified volumes match the forecasted volumes for Alternative B. Decrease of up to 600 vehicles. 25% HOV in managed lanes. 60% overall increase in HOV over No-Build during AM and PM Peak.
Signal Timing	Synchro and VISSIM models developed and updated with optimized signal timings.	No-Build models updated with Alternative A lane configurations and corresponding optimized signal timing where applicable (optimized split, phase order, and cycle length).	No-Build models updated with Alternative B lane configurations and corresponding optimized signal timing where applicable (optimized split, phase order, and cycle length).	No-Build models updated with Alt. B Modified lane configurations and corresponding optimized signal timing where applicable (optimized split, phase order, and cycle length).
Local Bus Boardings/ Dwell Time	Ride On Boardings North of I-495: +46% Ride On South of I-495: +0% WMATA North of I-495: +20% WMATA South of I-495: +5%	The changes in local bus ridership with Alternative A were obtained from the MWCOG model; changes represent decreases in local bus ridership due to riders switching from local buses to the BRT and some eliminated / modified transit lines.	The changes in local bus ridership with Alternative B were obtained from the MWCOG model; changes represent decreases in local bus ridership due to riders switching from local buses to the BRT and some eliminated / modified transit lines.	The changes in local bus ridership with Alternative B Modified were obtained from the MWCOG model; changes represent decreases in local bus ridership due to riders switching from local buses to the BRT and some eliminated / modified transit lines.
BRT Boardings/ Dwell Time	N/A	Daily Boardings: 18,120 Dwell Times reduced by 25% compared to Local Bus.	Daily Boardings: 16,430 Dwell Times reduced by 25% compared to Local Bus.	Daily Boardings: 17,310 Dwell Times reduced by 25% compared to Local Bus.
Transit Signal Priority	N/A	TSP thresholds met at two locations (AM only): -US 29 at Industrial Parkway -US 29 at Old Columbia Pike Connector	TSP thresholds met at two locations (AM only): -US 29 at Industrial Parkway -US 29 at Old Columbia Pike Connector	TSP thresholds met at two locations (AM only): -US 29 at Industrial Parkway -US 29 at Old Columbia Pike Connector

* While it is possible that some travelers that use their vehicles in the No-Build Alternative may shift to the new BRT service with Alternative A, the MWCOG model is demonstrating that there is enough latent demand for traveling the US 29 corridor that the drivers shifting modes from personal vehicle to transit will essentially be replaced or balanced out by latent demand.

6.4.1.2.2 Alternative A Traffic Analysis Findings Summary

The Alternative A proposed conversion of a general traffic lane in the peak direction to a BAT lane generates a range of effects. Alternative A would result in a lower BRT travel time through the median-lane and BAT-lane sections than the time for local bus or cars and trucks under No-Build conditions. However, there would be increased non-BRT vehicular travel time under Alternative A, increased delay at intersections with LOS F, increased number of vehicles denied entry (i.e., latent demand), and decreased vehicle throughput during the peak hours. The decrease in vehicle throughput results in an apparent improvement in traffic operations in some segments because fewer vehicles entering the corridor leads to improved travel times along US 29 and a decrease in miles of LOS E or F conditions. Alternative A reduces vehicle capacity along US 29 in the peak directions. In addition, subsequent studies of Alternative A will need to evaluate the traffic safety associated with the weaving conditions introduced to BRT in each southbound/northbound direction between the start/end point of the median BRT lane and the on/off ramp of Burtonsville park-and-ride/MD 198 interchange.

6.4.1.2.3 Alternative B Traffic Analysis Findings Summary

Due to the HOV vehicles and BRT service, Alternative B increases the total **person throughput** at all locations identified in the AM peak and along Lockwood Drive/Stewart Lane and US 29 north of Greencastle Road in the PM peak, while resulting in a decrease to the total **vehicles** within the network. The decrease in vehicle throughput results in some segments experiencing improvements; i.e., because fewer vehicles entering the corridor result in reduced travel times along US 29 and a decrease in miles of LOS E or F conditions. The overall impact of Alternative B shows that vehicular capacity is reduced, but that reduction is offset by higher vehicle occupancies. Another advantage of Alternative B is that it provides a BRT option with overall travel times that decrease by more than 10 percent in the peak direction, as compared to the local bus travel time in the No-Build Alternative. However, Alternative B's repurposing of a general traffic lane in the peak direction to a managed lane generates impacts to traffic operations, including increased travel time during both peaks for cars and trucks through the managed lane section, increased delay at intersections with LOS F, and increased number of vehicles denied entry (i.e., latent demand). In addition, subsequent studies of Alternative B will need to evaluate the traffic safety associated with the higher volumes of buses operating on the outside shoulders as compared to the existing conditions. Specifically, the convergence zones of

Overall, there is over a 60 percent increase in HOV vehicles in all lanes from the No-Build during the AM and PM peak hours with Alternative B and B Modified.

shoulders and interchange ramps will need to be evaluated for potential safety hazards with a higher volume of buses expected to operate on the outside shoulders.

6.4.1.2.4 Alternative B Modified Traffic Analysis Findings Summary

Due to the HOV vehicles and BRT service, Alternative B Modified increases the total **person throughput** at all locations identified in the AM peak and along Lockwood Drive/Stewart Lane and US 29 north of Greencastle Road in the PM peak, while resulting in a decrease to the total **vehicles** within the network. The decrease in vehicle throughput results in some segments experiencing improvements; i.e., because fewer vehicles entering the corridor results in improved travel times along US 29 and a decrease in miles of LOS E or F conditions. The overall impact of Alternative B Modified shows that vehicular capacity is reduced, but that reduction is offset by higher vehicle occupancies. In the northern section of the corridor, widening into the median space to create an exclusive bus and BRT lane significantly improves travel time for these modes with fewer impacts to general traffic. However, the repurposing of a general traffic lane in the peak direction to a managed lane generates a range of impacts, including increased travel time for the AM and PM peak directions through the southern managed lane section, increased delay at intersections with LOS F, and increased number of vehicles denied entry (i.e., latent demand). Similar to Alternative A, subsequent studies of Alternative B Modified will need to evaluate the traffic safety associated with the weaving conditions introduced to BRT in each southbound/northbound direction between the start/end point of the median shoulder BRT lane and the on/off ramp of Burtonsville park-and-ride/MD 198 interchange.

6.4.1.2.5 Traffic Operations Results: Alternatives Comparison

The traffic analysis results for the BRT alternatives along the US 29 corridor indicate a range of advantages and disadvantages for various roadway users when compared to the No-Build Alternative. In the peak period directions (i.e., southbound in AM; northbound in PM), corridor-level travel times for the BRT are better than for the local buses during similar No-Build conditions. During the AM peak in the southbound direction, person throughput increases at all six measured locations with the BRT alternatives when compared to no-build conditions except at a point north of Franklin Avenue with Alternative A where person throughput decreases less than two percent. During the PM peak in the northbound direction, person throughput increases at four of the six measured locations with the BRT alternatives compared to No-Build conditions. The conversion of a general traffic lane to a BAT lane (Alternative A) or managed lane (Alternative B and Alternative B Modified) in the southern portion of the corridor causes pinch points and queues that impact the northern portion of the corridor to various extents. However, the off-peak direction operates similarly to the No-Build Alternative for both

alternatives. The peak direction traffic analysis results are summarized below. **Table 6-16** provides a comparison summary of the alternatives.

6.4.1.2.6 Future Modeling Refinements

Possible refinements to the traffic modeling operations and transit and roadway improvements that may be considered as part of future analyses and design to further improve transportation performance associated with implementing the proposed BRT service include the following:

- *Traffic Modeling and Transit Operations Refinements:*
  - Enhancing signal timing refinements to reduce intersection delay, latent delay, and corridor travel time
  - Refining TSP locations with early green/green extension adjustments
  - Improving passive coordination by adjusting offsets to improve progression for BRT vehicles, particularly at BRT stations where BRT dwell time may degrade progression
  - Implementing conditional TSP
  - Allowing express/commuter bus service to activate TSP
  - Modifying Alternative B such that the managed lanes begin north of Sligo Creek Parkway
  - Maintaining the Ride On service routes 21 and 22
  - Removing the dedicated or managed lanes south of I-495 in both directions
  - Providing conditional TSP along the corridor to serve BRT and local buses
  - Implementing pedestrian improvements at locations with increased pedestrian activity to remove the conflict between general traffic and pedestrians
  - Providing additional roadway capacity at existing constraints, where feasible
  - Enhanced Transportation Demand Management programs to reduce single-occupant vehicle demand.
  - Alternative bus routing, particularly near the Silver Spring CBD.
- *Roadway Improvements to Consider:*
  - Improving the intersection at US 29 at MD 193 (including turning restrictions, rerouting traffic, and signal phasing/timing modifications)
  - Constructing a third southbound lane along US 29 over MD 650
  - Identify and evaluate the need for improvements at US 29 at Tech Road (including an interchange or other intersection improvements)
  - Constructing a pedestrian overpass at US 29 at Tech Road

It should be noted that most of these refinements have not been modeled as part of this phase of the project. However, they may be considered if these alternatives are further developed.

Table 6-16: US 29 BRT Alternative Comparison Table

Alternative Description:		2040 AM Peak Hour				2040 PM Peak Hour			
		No-Build	Alt A	Alt B	Alt B Modified	No-Build	Alt A	Alt B	Alt B Modified
Corridor Travel Time by Vehicle Type (minutes)									
North-bound	Cars and Trucks	**18.6**	18.4	19.5	18.6	**35.3**	43.2	32.1	32.4
	Local Bus	**27.5**	26.7	27.4	27.0	**44.5**	38.5	37.2	31.8
	BRT	**N/A**	22.8	23.1	23.6	**N/A**	36.5	34.3	26.9
	Weighted by Person	***19.5***	*19.4*	*20.5*	*19.6*	***36.7***	*40.6*	*32.2*	*30.5*
South-bound	Cars and Trucks	**44.0**	58.7	48.3	51.1	**24.3**	21.5	24.3	24.1
	Local Bus	**49.4**	60.2	33.0	29.0	**27.3**	28.3	28.9	27.3
	BRT	**N/A**	34.8	33.3	28.9	**N/A**	25.5	27.8	26.4
	Weighted by Person	***44.8***	*54.2*	*45.5*	*47.0*	***25.0***	*22.3*	*25.0*	*24.6*
Person Throughput at Select Locations (people)									
North-bound	South of Fenton St	**1,390**	1,560	1,580	1,590	**3,260**	2,320	2,490	2,750
	North of Franklin Ave	**2,090**	2,450	2,370	2,390	**4,770**	4,470	4,670	4,700
	South of Burnt Mills Shopping Center	**3,140**	3,450	3,430	3,440	**5,300**	5,100	5,540	5,590
	On Lockwood Dr	**500**	640	630	630	**940**	1,290	1,250	1,250
	North of Stewart Ln	**3,080**	3,290	3,310	3,310	**4,000**	4,490	4,460	4,590
	North of Greencastle Rd	**3,060**	3,070	3,070	3,090	**3,940**	4,200	4,170	4,230
South-bound	North of Greencastle Rd	**4,410**	4,720	4,660	4,740	**3,410**	3,420	3,420	3,430
	North of Stewart Ln	**3,270**	3,310	3,590	3,610	**3,260**	3,550	3,510	3,560
	On Lockwood Dr	**340**	790	780	790	**500**	650	640	540
	South of Burnt Mills Shopping Center	**4,450**	4,480	4,950	4,950	**3,390**	3,670	3,630	3,610
	North of Franklin Ave	**4,480**	4,410	4,980	5,010	**2,580**	2,720	2,670	2,690
	South of Fenton St	**3,730**	3,990	4,150	4,230	**1,790**	1,950	2,010	1,990
Miles of Poor or Failing Vehicle Speeds Along US 29 (miles)									
LOS	E or F	**7.3**	8.3	8.1	8.9	**5.4**	2.1	3.7	2.6
Intersections Operating at LOS E or F									
LOS	E or F	**7**	9	8	9	**17**	18	16	15
Network Statistics									
Total Delay (seconds)[1]		**12,276,000**	14,082,000	14,704,000	15,119,000	**13,102,000**	14,580,000	13,345,000	13,482,000
% Latent Demand (of all vehicles)[2]		**3%**	6%	7%	7%	**7%**	11%	9%	9%

1 – Total delay includes side street delay; does not include latent delay

2 – Latent Demand / [Vehicles(arrived)+Vehicles(active)+Latent Demand]; Latent demand includes the vehicles that could not be served during the one-hour peak simulation period

10% or more worse than No-Build

10% or more better than No-Build

6.4.2 Potential Socioeconomic, Cultural, and Natural Environmental Impacts

Potential impacts to socioeconomic, cultural, and natural environmental resources are summarized in sections and in **Table 6-17** below.

6.4.2.1 *Potential Socioeconomic Impacts to Properties (Right-of-Way)*

The No-Build Alternative would require no right-of-way impacts or displacements. Each of the conceptual build alternatives would require both temporary easements to facilitate construction activities and permanent property acquisition throughout the study corridor. At this time there are no anticipated displacements or relocations of existing residences or businesses.

Due to the preliminary nature of the design detail and property boundary data, the potential right-of-way impacts are provided as ranges for the purposes of these preliminary study findings.

6.4.2.2 *Potential Impacts to Cultural Resources (Historic Properties)*

The No-Build Alternative would not impact any existing historic properties within the study corridor. Each of the conceptual build alternatives have the potential to impact historic properties, as summarized in **Table 6-17**. Future studies will need to perform a full effects determination study to document the potential impacts to these resources along with all minimization and avoidance options investigated. Due to the preliminary nature of the design detail and historic property boundary data, the potential impacts are provided as ranges for the purposes of this report.

6.4.2.3 *Potential Impacts to Waters of the U.S., Including Wetlands, Floodplains, and Forested Areas*

The No-Build Alternative would require no impacts to Waters, Wetlands, Floodplains, or Forested Areas. Each of the conceptual build alternatives would potentially impact these existing natural environmental features as summarized in **Table 6-17**. Future studies will need to perform detailed resource delineations to document the potential impacts related to the proposed construction needs. Due to the preliminary nature of the design detail and resource boundary data, the potential impacts are provided as ranges for the purposes of this report.

Table 6-17: Alternatives Comparison Matrix – Environmental Impacts

Evaluation Criteria	No-Build Alternative	Alternative A	Alternative B	Alternative B Modified
Socioeconomic				
Total ROW Required (acres)	0	2-4	3-6	2-4
Properties Impacted (number)	0	5-20	20-30	5-20
Residential Relocations (number)	0	0	0	0
Business Displacements (number)	0	0	0	0
Public Parks Affected (number)	0	1	1	1
Public Park Property Required (acres)	0	0-0.2	0-0.2	0-0.2
Total Number of Public/Community Facilities Permanently Impacted	0	1	2	2
Cultural Resources				
Historic Properties (acres)	0	0-0.1	0-0.1	0-0.1
Natural Resources				
Stream Impact (linear feet)	0	0-20	0-125	0-20
100-Year Floodplain (acres)	0	0-0.5	0-1	0-0.5
Wetlands (acres)	0	0-0.2	0-0.2	0-0.2
Forests (acres)	0	1-3	2-5	1-3
Federally or State Listed RTE Species (number)	0	0	0	0

6.4.2.4 *Impacts to Water Quality and Groundwater*

Modification of hydrologic features due to construction activities could impact water quality. Alternative A would result in approximately 9.5 acres of new impervious surface. Alternative B would result in approximately three acres. Alternative B Modified would have approximately nine acres of new impervious surface. The introduction of new impervious surfaces could modify existing hydrology and possibly destabilize channel and stream banks, increase erosion and sediment loads in the stream, and affect overall water quality.

Using the Best Management Practices (BMPs) in accordance with Maryland's Stormwater Management Act (MSMA), the Study Team has initiated the conceptual development of new proposed stormwater management and environmental site design facilities throughout the corridor to address preliminary estimates for stormwater management retention and treatment. See alternatives mapping in **Appendix A** for the location of these proposed facilities. In some cases these proposed facilities may require temporary and permanent right-of-way acquisition. Additional detailed studies will be required to finalize these study findings.

6.4.3 Estimated Costs

The following is a description of the methodology and resulting cost estimating analysis for the proposed conceptual build alternatives.

6.4.3.1 *Cost Estimating Methodology*

The following sections describe the preliminary methodologies used to develop planning-level costs estimates for preliminary conceptual proposed roadway and station infrastructure improvements associated with Alternatives A, B, and B Modified.

Due to the preliminary nature of the data available and the considerable number of unknown design challenges that could arise, the Study Team developed high-end and low-end estimates for the conceptual build alternatives. The high-end estimates represent a conservative approach for the highest assumed magnitude of infrastructure improvements and associated costs involved. Conversely, the low-end estimates represent a scenario where the needed improvements are assumed to be less complicated and therefore less expensive. Differences in material quantities, element sizes, finishes, and amenities vary depending upon the high-end versus low-end estimating approach. In addition, currently non-quantifiable construction elements related to drainage, utility relocation, traffic, landscaping, environmental monitoring, and systems integration were accounted for using industry accepted methods of applying percentage-based calculations to develop costs for these unknown items. These percentage-based costs will be used as placeholders until more details on these can be developed and made available as the project progresses. Similar to the quantifiable elements, high-end and low-end percentages were used to generate a range of potential costs.

6.4.3.2 *Roadway Infrastructure*

The roadway infrastructure construction costs were developed based on recommended methodology and guidance on unit prices documented in the **MDOT/SHA *2015 Highway Construction Cost Estimating Manual* and 2016 SHA Price Index**. The estimates include various elements related to preliminary site preparation, earthwork, drainage, structures, pavement, shoulders, landscaping, traffic, utilities, and other roadway construction related elements for conceptual Alternatives A, B, and B Modified.

Estimations of cost for conceptual Alternatives A, B, and B Modified were prepared. These estimates assign unit costs for all known quantifiable elements associated with the proposed infrastructure improvements.

In addition to using quantifiable materials and costs, industry accepted standard practices for projects at this stage of planning commonly utilize percentage-based calculations to account for elements where detailed design information is not currently available.

6.4.3.3 *Station and Platform Elements*

The station costs were calculated using the different size BRT Station typologies described above and guidance on unit prices based on research and previous project experience, such as the CCT BRT project. The US 29 approach is also based on coordination regarding the assumptions and methodology used for the similar MD 586 Corridor Planning Study.

The cost of each component was estimated individually using assumed quantities per the station typology and unit cost to calculate the total cost. These costs include the platform and canopies for the passenger waiting area, architectural elements, signage, and general assumptions for the mechanical/electrical/plumbing/ fire protection elements.

The Minimal Curbside station typology (9' x 18' platform) has the lowest cost estimate of approximately $175,000 each, followed by the Curbside (Single Bus) station typology (11' x 63' platform) which has a cost of approximately $261,000 each, and the highest cost estimate for the dual bus Curbside Station typology (11' x 125' platform) at $511,000 each.

Similar to the roadway portion of the cost estimates, the station and platform design detail is limited at this stage of planning. Percentage-based calculations are also used to account for those elements that cannot be quantified at this time.

6.4.3.4 *Systems Elements*

The station costs listed above do not include the systems elements; the MDOT team is recommending that additional costs for the systems elements be added to each station. Based on the 30 percent design cost estimate for the CCT, the estimates for the systems elements that are not included in the cost estimates listed above are: Ticket Vending Machine, Real-Time Passenger Information Display, Emergency Blue Phones, CCTV, Fare Card Validators, Local Area Network (LAN), and potentially System Enclosures (at larger stations).

The Minimal Curbside station typology (9' x 18' platform) and the Curbside (Single Bus) station typology (11' x 63' platform) are both assumed to need similar systems elements with a cost of approximately $62,000 each, but the dual bus Curbside Station typology (11' x 125' platform) is assumed to need systems elements with a cost of approximately $144,000.

Similar to the roadway and station portion of the cost estimates, the system design detail is limited at this stage of planning. The corridor wide system elements such as running way duct

bank/conduits, fiber/wire, and systems junction boxes are assumed as a percentage calculation for the US 29 estimates. As the design progresses, it may be determined that duct bank/conduits, fiber/wire, and systems junction boxes are only needed in limited cases or not at all.

The systems estimate does not include Central Control/System Integration elements like dispatch hardware ($20,000 per workstation), AVL integration ($150,000), APC Software ($60,000), or vehicle security monitoring system ($10,000). This will be dependent of the operator of the BRT and/or other corridor connections. If the operator has existing control center, or a control center is constructed under another BRT project, the US 29 BRT may just need additional workstations only.

6.4.3.5 *Contingencies and Additive Rates*

The Overhead Additive is an estimate of the incidental costs related to a project. Additives include items such as fringe benefits, vehicles, equipment, lab testing, office supplies, construction inspection, etc. The project costs shown in the Ad Schedule and Consolidated Transportation Program are the neat construction estimate plus the Overhead Additive. The Overhead Additive Rate should also be included in any third party participation if SHA is to provide construction inspection and testing on the work to be done. For this project we are using the SHA recommended Overhead Additive Rate of 15.3 percent for construction of a Major Project.

In addition, a Contingency percentage is the amount added to the estimated construction cost to account for unknowns throughout the design process. For this project we are using the SHA recommended contingency percentage of 35 percent for construction of a Major Project currently in the planning/concept development phase.

6.4.3.6 *Additional Related Infrastructure and Systems Costs*

The construction costs described above are only one component of the overall project costs. There will also be costs associated with right-of-way acquisition, new bus procurement, and operating costs.

6.4.3.6.1 Right-of-Way Costs

Right-of-Way costs were developed utilizing available property value information for properties along the US 29 Corridor. The Study Team utilized available land and improvement (buildings/dwellings) tax assessment data, along with historical property sales data to generate an assumed cost per acre to purchase residential and commercial land. There are no displacements anticipated for this project, so no building purchases are included in the

estimates. Future phases of study will need to coordinate with SHA to refine and finalize potential right-of-way cost estimates.

6.4.3.6.2 Preliminary Bus Procurement

Montgomery County DOT is preparing the specifications for the BRT buses now. Until more information is made available, the Study Team is assuming the total cost of buses will be approximately $1 million each. At this time, based on the operating assumptions and anticipated ridership, the following number of buses would need to be purchased for each alternative:

- Alternative A – 21 Buses at $21million
- Alternative B – 17 Buses at $17 million
- Alternative B Modified – 19 Buses at $19 million

6.4.3.6.3 Preliminary Annual System Operations

The Study Team is estimating that the annual system operations of buses, including driver, fuel, maintenance, cleaning, etc., will cost $8.8 to $9.8 million for Alternative A, $7.6 to $8.6 million for Alternative B, and $8.5 to $9.5 million for Alternative B Modified. While system operations are not considered part of the total capital costs, they are an important factor to consider when evaluating different alternatives and their respective operating needs.

6.4.3.7 *Cost Summary*

Table 6-18 provides a summary of the estimated costs to construct the BRT infrastructure needs to support the proposed alternatives. All costs are presented in ranges. Construction costs, right-of-way costs, and bus procurement are combined to estimate the total capital costs. The system operations costs are noted separately; however, they carry similar importance for comparing alternatives.

Table 6-18: Summary of Estimated Infrastructure Costs

	Construction Cost ($M)	+ Right-of-Way Cost ($M)	+ Bus Procurement Cost ($M)	= Total Capital Costs ($M)	Annual Operations Cost ($M)
Alternative A	$80 to $112.4	$1.5 to $3.0	$21	$102.5 to $136.4	$8.8 to $9.8
Alternative B	$60 to $107.9	$2.0 to $4.5	$17	$79.0 to $129.4	$7.6 to $8.6
Alternative B Modified	$77 to $105.6	$1.5 to $3.0	$19	$97.5 to $127.6	$8.5 to $9.5

6.5 Level Four: Environmental Analysis / Preliminary Engineering

Completing the four step process outlined at the beginning of this Chapter, the Study Team would continue the project development by formally entering into the NEPA process and carry on the more detailed environmental analysis and preliminary design engineering for the recommended alternative. This recommended alternative would be presented to the public, elected officials, and other decision makers as the option that would be carried forward for NEPA approvals and preliminary design and engineering (up to 30 percent design). Federal, State, and local agencies would need to concur or comment on the recommendation and the lead Federal Agency would need to provide NEPA concurrence and approvals before any federal funds can be used to implement the alternative. Once these approvals have been achieved, the alternative would require environmental clearances to move forward through future design and construction implementation phases. Level Four was not completed for this study.

7 Public Involvement and Agency Coordination

7.1 Introduction

Public Involvement has played an important role in the US 29 BRT Corridor Planning Study and includes CAC and a project web site which are described in more detail below.

7.2 Corridor Advisory Committees

At the outset of the US 29 BRT Corridor Planning Study, the County initiated two CACs comprised of stakeholders representing the US 29 Study Area. The work of the CACs began with a kickoff meeting on February 28, 2015 and has continued through the publication of this report. The US 29 South CAC includes approximately 40 stakeholders focused on the southern part of the Study Area from Silver Spring to the White Oak area. The US 29 North CAC includes approximately 15 stakeholders focused on the northern part of the Study Area from the White Oak area to Burtonsville.

The Mission Statement for the US 29 North and South CACs is to:

- Give community participants the opportunity to provide input to all planning and design efforts.
- Provide the opportunity to discuss study assumptions and methodologies.
- Fulfill County Council requirements for transparency and community involvement.
- Provide the opportunity for interaction and information-sharing among impacted residents/communities, property owners of businesses/institutions, transportation agency representatives, and transportation system users.
- Study and discuss potential community impacts in a comprehensive manner that supports cost-effective and context sensitive and community sensitive implementation outcomes.
- Serve as a clearinghouse for sharing of timely and accurate information on the studies and plans in each section of the corridor.
- Share information from the CAC meetings with the community groups that members represent and share input received from them during subsequent CAC meetings; and
- Provide leadership and build consensus within the community to coalesce diverse interests and address stakeholder issues.

The work of both the US 29 North and South CACs progressed concurrently with each group following roughly the same schedule and receiving similar technical content. In addition, each CAC had a unique professional facilitator to lead the CAC meetings and be the point of contact for all correspondence before and after CAC meetings.

Although the topic and goal of each CAC meeting was unique, the general meeting approach was to make structured presentations followed by opportunities to ask questions or make comments. Each meeting typically wrapped up with breakout exercises or table-top discussions designed to provide opportunities for the CAC members to provide feedback on the progress of the planning study and to speak one on one directly with a Study Team member. Each meeting typically lasts between 2.5 and three hours.

Figure 7-1: Study Team Members Discuss Proposed Station Locations with CAC Members

7.3 CAC Schedule of Meetings

The following is the CAC meeting schedule through the publication of this report. The topics for each meeting are discussed in the next section.

US 29 South CAC

- Meeting #1 – February 28, 2015
- Meeting #2 – March 31, 2015
- Meeting #3 – June 2, 2015
- Meeting #4 – September 10, 2015
- Meeting #5 – December 2, 2015
- Meeting #6 – May 24, 2016
- Meeting #7 – July 14, 2016
- Meeting #8 – September 26, 2016
- Meeting #9 – January 31, 2017

US 29 North CAC

- Meeting #1 – February 28, 2015
- Meeting #2 – March 26, 2015
- Meeting #3 – May 28, 2015
- Meeting #4 – September 8, 2015
- Meeting #5 – December 1, 2015
- Meeting #6 – May 18, 2016
- Meeting #7 – July 20, 2016
- Meeting #8 – September 22, 2016
- Meeting #9 – February 2, 2017

In addition to the above referenced CAC meetings, there was a combined (north and south) US 29 CAC Open House on February 1, 2016. The purpose of the CAC Open House was to allow members of the CAC to interact with project team members on the Draft Preliminary Purpose and Need document prior to submitting questions and comments.

All information related to the work of the CACs is posted on the project websites. See below for more details on the websites.

7.4 CAC Meeting Topics

Through the course of the CAC process, CAC members have participated in discussions on many topics relevant to the BRT Corridor Planning Process. Among the topics covered during the process were:

- The Project Development Process
- US 29 Existing Conditions
- Existing and Forecasted Transit Ridership
- Existing and Forecasted Traffic Operations
- Draft Preliminary Purpose and Need
- Alternatives Selection Analysis Goals and Objectives
- Conceptual Alternatives Development
    - Running way Options
    - Preliminary Service Plan
    - Preliminary Station Locations

7.5 CAC Meeting Exercises

Through the course of the CAC process, CAC member participated in numerous exercises and discussions to give feedback to the Study Team. These exercises included:

- A map exercise to gain feedback from the CAC on:
    - How they and people they know use transit;
    - For what purposes, do they use the US 29 corridor; and
    - Ideas to make using transit more attractive.
- An exercise to identify “Strengths” and “Opportunities” within the US 29 Corridor.

- An exercise to identify "Needs, Values and Concerns" related to transit investment in the US 29 Corridor.
- A breakout discussion on appropriate running ways, station locations and service plans.

7.6 Project Websites

A website has been in place from the start of the US 29 BRT Corridor Planning Study. The website (www.montgomerycountymd.gov/brt) is regularly updated with new information related to the CAC process and Public Meetings. The website offers the public the opportunity to submit comments related to the Public Open Houses or email the project team.

Additionally, the County has recently launched a new website (www.getonboardbrt.com) to engage the community on BRT in general.

GetOnBoardBRT
BUS RAPID TRANSIT IN MONTGOMERY COUNTY

7.7 CAC Meeting Materials

All materials presented at CAC meetings are placed on the website for review by the public. These materials include agendas, presentations, mapping and meeting summaries.

7.8 CAC Meeting Summaries

A detailed meeting summary for each US 29 CAC meeting is produced at the conclusion of each meeting. The meeting summary is developed by the project team and reviewed by the CAC members before being made final. These CAC meeting summaries are placed on the project website to allow for public review. In addition, a video of each CAC meeting (Starting with CAC meeting #4) is also on the website for the public to review.

Acronyms

ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
APE	Area of Potential Effect
ASTs	Aboveground Storage Tanks
BMPs	Best Management Practices
BRT	Bus Rapid Transit
CAC	Corridor Advisory Committee
CBD	Central Business District
CCT	Corridor Cities Transitway
CFR	Code of Federal Regulations
CLRP	Constrained Long-Range Plan
COMAR	Code of Maryland Regulations
DBH	Diameter Breast Height
DC	Washington, D.C.
DCSR	Draft Corridor Study Report
DHHS	Department of Health and Human Services
EJ	Environmental Justice
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIDS	Forest Interior Dwelling Species
FTA	Federal Transit Administration
FY	Fiscal Year
GIS	Geographic Information System
ICC	Intercounty Connector (MD 200)
ICE	Indirect and Cumulative Effects

LF	Linear Feet
LOD	Limits of Disturbance
LOS	Level of Service
MCDOT	Montgomery County Department of Transportation
MCFRS	Montgomery County Fire and Rescue Services
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MDOT	Maryland Department of Transportation
MHT	Maryland Historical Trust
M-NCPPC	Maryland-National Capital Park and Planning Commission
MOT	Maintenance of Traffic
MTA	Maryland Transit Administration
MWCOG	Metropolitan Washington Council of Governments
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
OTP	On-Time Performance
PFA	Priority Funding Areas
PRD	Project Review Department
PRSA	Pedestrian Road Safety Audit
ROW	Right-of-way
RTE	Rare, threatened, or endangered
SHA	State Highway Administration
SHPO	State Historical Preservation Officer
TIP	Transportation Improvement Program
TMP	Transportation Management Plan
TOD	Transit-Oriented Development
TPB	Transportation Planning Board

TSM	Transportation System Management
TSP	Transit Signal Priority
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
WMATA	Washington Metropolitan Area Transit Authority
WSSC	Washington Suburban Sanitary Commission

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APPENDIX A

CONCEPTUAL BUILD ALTERNATIVE

DRAFT DESIGN PLANS